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Solid Waste Disposal Alternatives for the U.S. Military Academy

by
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The U.S. Military Academy (USMA) at West Point, NY, currently disposes of its solid wastes through several contractors at the Orange County (NY) landfill. This landfill is expected to run out of space within 5 years, and expansion of the landfill cannot be assumed because it is located over a primary aquifer. Therefore, USMA must have a solid waste disposal plan in place and ready to operate within 5 years, but formulating such a plan is complicated by technical, political, and regulatory considerations.

This report discusses the major issues USMA has had to consider in its attempt to create a solid waste plan, including disposal alternatives, costs, siting and environmental issues for landfills and waste incinerators, and the role of recycling. The authors recommend economically viable solid waste management alternatives for USMA.

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FOREWORD

This study was conducted for the Directorate of Public Works (DPW), U.S. Military Academy (USMA), West Point, NY, under Project Order MAEN-57-89, dated 3 January 1989. Richard Heidmann and Harish Sharma were the DPW USMA technical monitors.

This research was performed by the Energy and Utility Systems Division (FE) of the Infrastructure Laboratory (FL), and the Pollution Prevention Division (EP) of the Environmental Sustainment Laboratory (EL), U.S. Army Construction Engineering Research Laboratories (USACERL). Dr. David M. Joncich is Chief, CECER-FE, and Dr. Michael J. O'Connor is Chief, CECER-FL. Dr. Edgard D. Smith is Acting Chief, CECER-EP, and William Goran is Chief, CECER-EL. The USACERL technical editor was Gordon L. Cohen, Information Management Office.

LTC David J. Rehbein is Commander of USACERL and Dr. L.R. Shaffer is Director.

CONTENTS

FIGURES AND TABLES

SOLID WASTE DISPOSAL ALTERNATIVES FOR THE U.S. MILITARY ACADEMY

1 INTRODUCTION

Background

The generation of municipal solid waste (MSW) in the United States is increasing. At present, the United States generates 150 million tons of municipal solid waste (MSW) per year and is expected to generate 180 million tons of MSW per year by the year 2000 (Thomas 1988). This increase is not simply a result of population growth. In 1960, the United States generated MSW at a rate of 2.65 lb per person per day; by 1986, that figure had jumped to 3.58 lb, and the rising trend is projected to continue into the year 2000 (Franklin Associates, Ltd. 1988). Figure 1 shows national trends in types of MSW discarded. The generation of most types of MSW, including paper, plastics, glass, and metals, has increased.

Currently, over 80 percent of the nation's MSW is landfilled, 10 percent is recycled, and 10 percent is burned (Kilgore 1989). While more wastes are being generated, the capacities for processing and disposal are diminishing. It has been estimated that two-thirds of the landfills existing today will be full by the year 2000 (Cocoran 1989). Figure 2 shows landfill shortage areas in the United States. The Northeast, including the State of New York, has a severe landfill capacity shortage. Figure 3 shows a sharp decline in the number of active New York State landfills during a recent 23-year period. This decline will probably continue since the New York State Department of Environmental Conservation (DEC) has a goal of reducing the number of active landfills to fewer than 100 by 1997 (New York State Solid Waste Management Plan, March 1988). Therefore, alternative MSW management techniques will have to be employed to handle the MSW that will not be landfilled.

Although there is an ever-increasing need for MSW handling and disposal facilities, there is mounting public opposition to their siting. The public has a distrust of landfills and heat recovery incinerators (HRIs). There is a perception that these technologies pose unacceptable environmental or health risks. Also there is opposition to solid waste management facilities due to perceptions of problems with noise, odors, increased truck traffic, infestation by insects and rodents, and fear of depressed property values. In response to the public's concerns, many states have strengthened environmental regulations dealing with MSW management. In the past few years, the New York DEC's MSW management regulations have become among the most stringent in the nation.

Presently, the U.S. Military Academy (USMA) at West Point, NY, is disposing of its wastes through several contractors at the Orange County (NY) landfill. The landfill has approximately 5 years of available space remaining. Future expansions at the Orange County site are not guaranteed since it is located over a primary aquifer. Within less than 5 years, the USMA must determine how it will dispose of its waste after the present landfill expansion closes, or how it may influence extending the landfill's life. In addition, the waste generated by USMA represents a potential source of renewable energy. The technical and economic feasibility of recovering that energy must also be considered as one of the disposal options. A solid waste management plan must be developed that will include aspects of source reduction, recycling, composting, heat recovery incineration, and landfilling. If any Military Construction, Army (MCA) capital expenditures are involved, the available lead time is less than allowed by normal financial planning procedures.

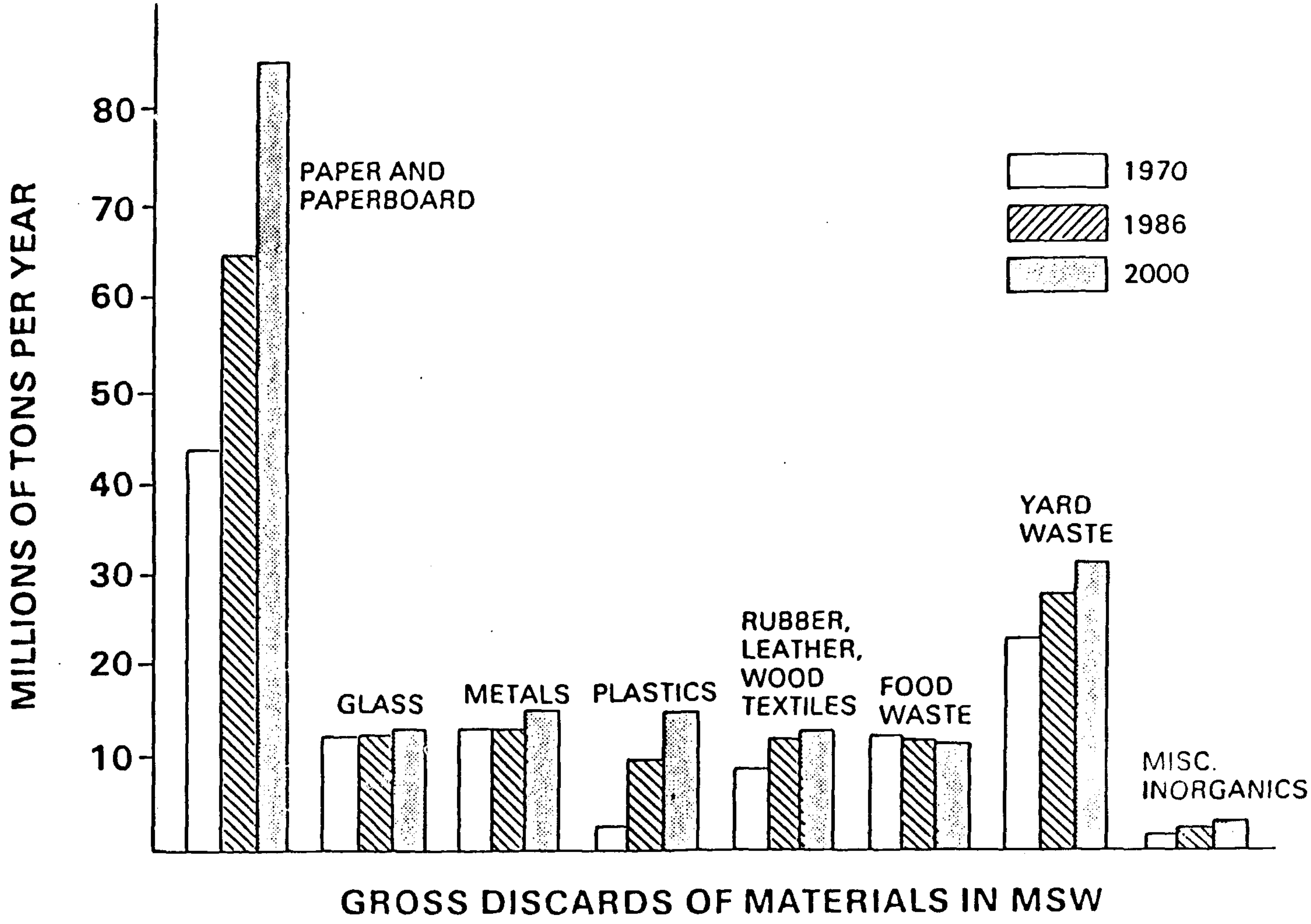

Figure 1. Trends in the generation of MSW materials. (Source: J.D. Kilgore.)

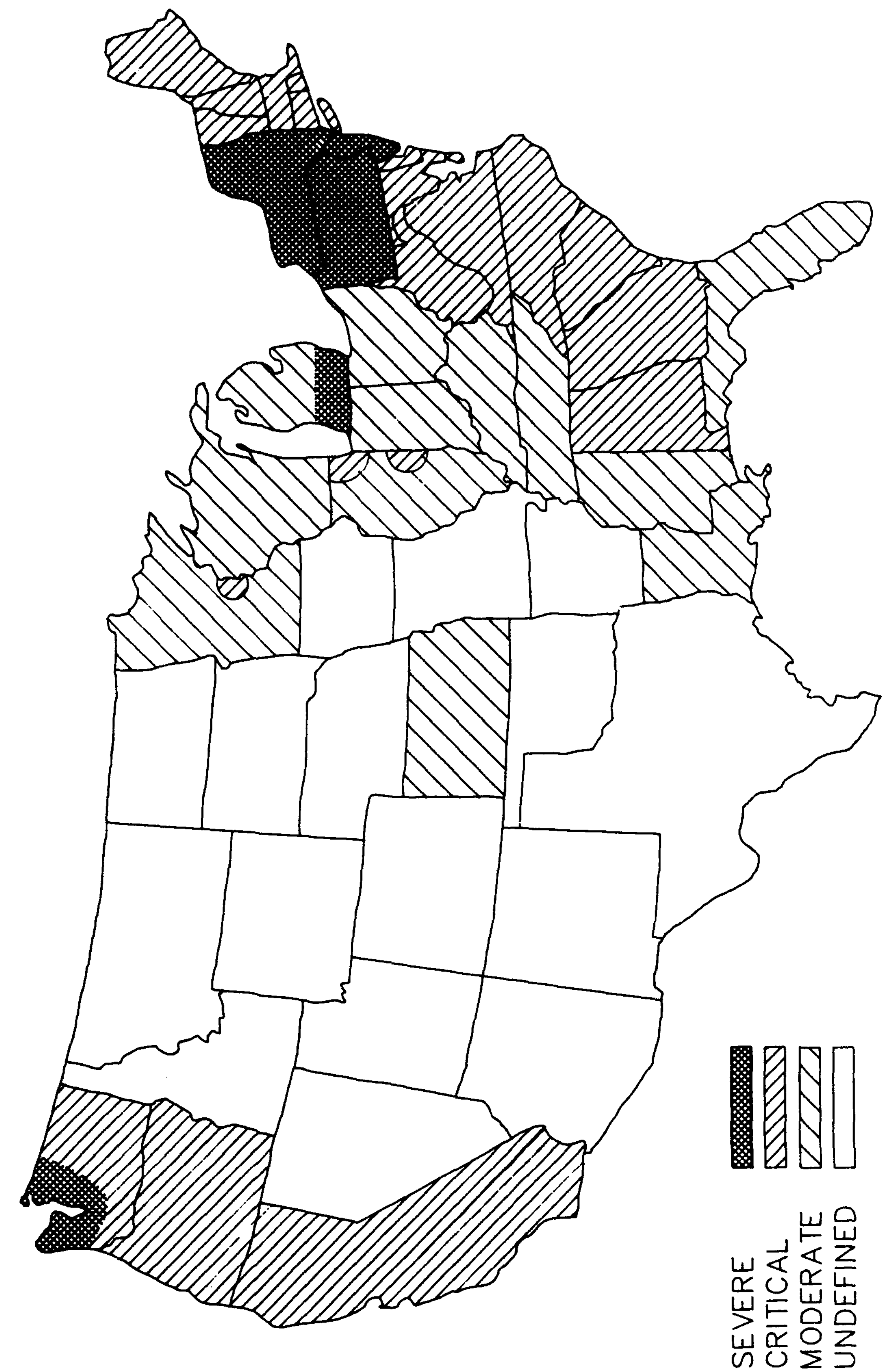

Figure 2. Landfill shortage areas.

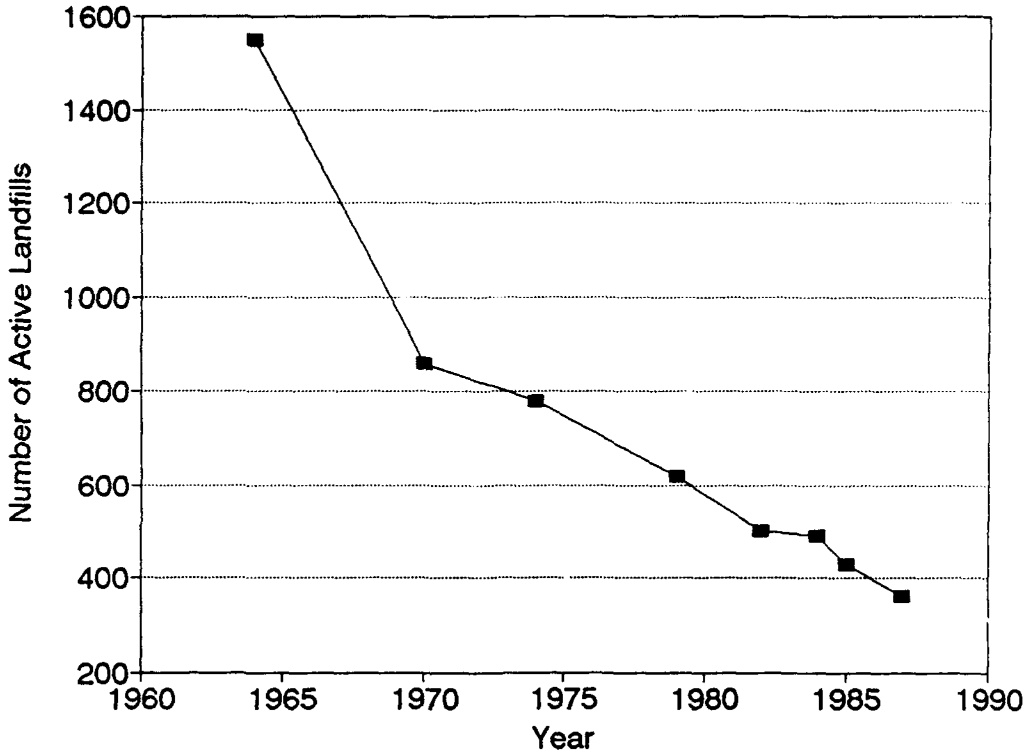

Figure 3. Decline in the number of active New York landfills. (Source: New York State Solid Waste Management Plan (New York Department of Environmental Conservation [DEC], Division of Solid Waste, March 1988).

Objective

The objective of this study is to recommend economically sound solid waste management alternatives for USMA, including justification for any capital expenditures.

Approach

The approach was to first identify all technically feasible alternatives that USMA could use to dispose of its wastes. Previous reports were reviewed for helpful information. Capital and operating-cost information then were developed. The alternatives were analyzed to determine which one would be the most economical, based on life cycle cost.

It was determined what plans, if any, the present and other potential total-service contractors have for waste disposal after the present landfill closes. Contractor options include the potential for opening a new landfill on property owned by or located near USMA, any regional incinerator plants being planned, and the potential for building a "third party" incinerator plant for USMA. Local environmental regulations were also investigated to determine their impact on these and other options. Estimates were obtained on the costs associated with these options.

Inquiries were made to determine what commercial landfills are or will be available, and the costs associated with using them including transportation. The possibility of building a landfill on USMA property was also considered.

Information and cost estimates (including transportation) were also obtained for commercial municipal waste incinerator facilities that are currently available or will be soon. The implications of an on-site HRI plant were also investigated, including the impact of local air pollution control and ash disposal regulations. A budgetary estimate (+/- 25 percent) for such an HRI was made for capital construction and operations and maintenance (O&M) costs.

All information gathered was analyzed for strengths and weaknesses in terms of economics, environmental impact, political viability, O&M costs, energy goals, staffing, commercial activities, and MCA funding.

Scope

This study was conducted specifically for, and is directly applicable only to, the U.S. Military Academy at West Point. However, it may be used as a example by other Army installations in requesting the development of a Waste Management Plan, and by servicing Corps of Engineers districts or commercial contractors that may be tasked to such a plan.

2 FINDINGS OF THE STUDY

Contractor Plans for Disposal Alternatives

At the time this study was initiated, the Orange County landfill was faced with imminent closure. However, the County has received a permit to expand its landfill into a new area of the current site. Telephone contacts with USMA's contract haulers, Falls Sanitation and Milton Sanitation, indicate that, as a result of the extension of the County landfill, they have not been examining alternate disposal options for USMA waste. These two primary haulers did express concern about how future pickups of recyclable materials will be handled. Milton Sanitation was considering the Dutchess County (NY) incinerator plant as a possible disposal option for another client. Neither contractor was able to provide any information on the cost of transporting waste in terms of dollars per ton per mile.

American Medical Waste, USMA's contractor for disposing of infectious and pathological waste from Keller Army Hospital was also contacted. For some time the hospital has treated almost all materials that come into contact with patients as infectious waste. At the time it was established, the policy may have been overly conservative. However, the recently enacted Medical Waste Tracking Act (40 CFR 259 as amended) has broadened the definition of infectious waste and mandates policy almost as stringent as that at Keller Hospital. An American Medical Waste official said the company currently transports USMA's medical waste to an incinerator in South Carolina. The company knows of no commercial medical waste incinerators in the State of New York, and the unit in South Carolina is the closest one available (Dana Alessandria, Contract Manager, American Medical Waste, professional discussion, 1989). No transportation cost figures (dollars per ton per mile) were available, but the company official said that a much closer incinerator would significantly reduce the disposal cost.

County Plans for Disposal Alternatives

According to the Orange County Commissioner (Goshen, NY), the main problem in waste management planning is determining what the New York legislature and DEC are going to do. Both the state's solid and hazardous waste management laws and the solid waste management rules have been amended frequently in the past few years. In requesting an expansion of the landfill, the county asked for 154 acres but only received approval for 75 acres, which will last only 5 to 7 years. This extension is essentially a new landfill sited next to the existing one (built in 1974). There is currently some leachate leakage, and the site is over a principal aquifer, which ends at the opposite side of the landfill bounded by the Wallkill River. A new leachate collection/treatment plan that complies with the latest requirements is awaiting approval by DEC. Construction of the new landfill costs $70 million, plus $1.8 million for engineering and legal fees. The tipping fee rose to $60/ton in January 1990 while an adjacent commercial landfill was charging only $62.50/ton. The existing landfill will cost $15 million to $20 million to close. William Cosulich Engineers finished a study for the county on future waste management options in September 1990. The report includes incinerator options.

Although state-mandated recycling was supposed to become effective on 1 June 1989, it was delayed until August. The county currently has several drop-off centers for paper and glass. All Waste Inc. operates the drop-off centers and hauls the separated materials to recyclers. To overcome slowness by the affected towns, proposed county legislation would make curbside recycling pickups the responsibility of the haulers, and would be enforced by requiring each hauler to be licensed. Initially curbside pickups will be only for paper and clear glass. A detailed county recycling plan is being developed by another consultant. The county executive has decided that all types of recyclables will be collected in the same container. A partially automated Material Recovery Facility (MRF) will separate the materials. The equipment will be similar to a Refuse-Derived Fuel (RDF) facility. Recyclable materials are sold to Garden State, a broker, but office paper is collected in STOP (Save That Office Paper) boxes.

A sewage sludge composting facility being developed by the county is expected to charge $75/ton. A company called CMC is proposing a plan for chemical treatment of medical wastes. The city of Newburgh, NY, desires some type of 700 tons-per-day (TPD) system, possibly an RDF or compost facility. Surrounding towns are supportive as long as the facility is located in Newburgh, which needs to increase its tax base. However, construction of a facility seems unlikely because of permit and public opposition problems.

During the time this research was conducted a new County executive was elected. This new executive included a policy of "no burn" in her campaign. A citizen's advisory council for waste management has also expressed opposition to waste incineration. The consideration of a waste-to-energy plant at Stewart Airport, Newburgh, is opposed by the New York Department of Transportation (which operates the airport).

Indications are that Orange County will rely heavily on recycling to minimize its waste stream, and continue to landfill. The actions and policies being adopted by Orange County are very similar to the solid waste management situation several years ago in Burlington County, NJ, where Fort Dix is located. The MRF constructed by Burlington County is being converted to an RDF plant. The RDF will initially be used as a bulking agent for composting sewage sludge. Due to the limited market and lack of appropriate disposal sites for compost, Burlington County is currently investigating combustion technologies for burning RDF and compost to minimize disposal costs and landfill capacity requirements.

Landfills

The combination of landfill capacity shortages, problems in siting MSW management facilities, and more stringent environmental regulations has created a market of escalating MSW disposal costs. Figure 4 shows the national and Northeast regional average tipping fees for landfills and HRIs. This figure was developed from National Solid Waste Management Association (NSWMA) annual tipping fee surveys. The costs were provided by operators who volunteered to participate. Therefore, the sample averages may not be accurate reflections of the true averages of all tipping fees across the country. However, these figures are useful for indicating trends. One trend the figure illustrates is the large increases in landfill tipping fees over the past few years. These increases have been especially large in the Northeast. In fact, increases in the national average have largely been driven by increases in the Northeast. HRI tipping fees have also increased dramatically since 1982. The increases have been steadier than for landfills, and HRIs continue to have larger tipping fees than landfills.

The 1987-88 update to the *New York State Solid Waste Management Plan* indicates that New York City currently has the largest remaining landfill capacity, but that this capacity will be exhausted by 1999. It indicates that most County and or municipal run landfills would be unwilling to accept outside waste. Shipping waste outside of New York is possible, but only at a very high cost. Many Long Island communities pay $120/ton or more to transport and dispose of their municipal waste as far away as Ohio, Michigan, and Kentucky.

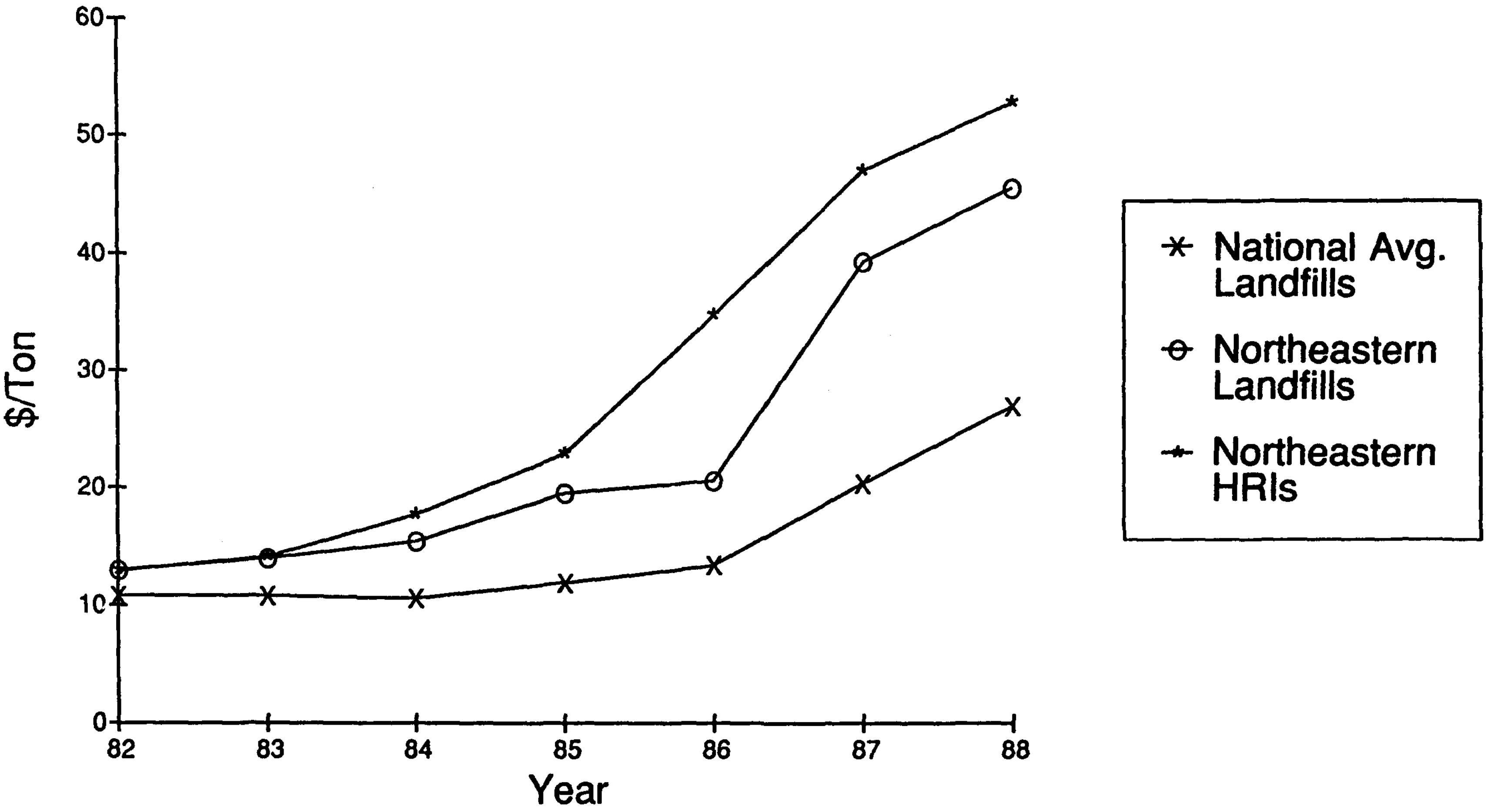

Figure 4. Tipping fee trends. (Source: *Waste Age*, 1983-1989).

The information in Table 1 was obtained through telephone contacts with New York DEC personnel. It lists landfills in the New York counties neighboring USMA. The large number of landfills expected to close in the next few years is alarming. These landfills typically serve small populations, are unlined, and do not possess leachate collection systems. They can no longer economically operate under the very strict New York DEC landfill regulations. Although they are small, these facilities collectively represent a large portion of the area's remaining landfill capacity.

The tipping fees presented in Table 1 can be somewhat misleading. If solid wastes are shipped to a landfill owned by someone else, the tipping fee is an accurate measure of the disposal cost to the solid waste generator. However, tipping fees may not give a full indication of a landfill's costs to its owner. In the case of publicly owned landfills, operating costs are often subsidized by taxes or the budget of the agency. Landfill tipping fees may also be artifically low because they are often based only on the operating expenses of the landfill, and do not take into account the capital costs of construction, equipment, or the future costs of closure and post-closure care. For privately owned landfills, the tip fees more closely represent actual costs to the landfill owner. However, even the tipping fe commercial landfills will deviate from actual costs due to market forces. The rise in tipping fees at the Orange County Landfill reflects the increased costs of compliance with stricter environmental regulations and perhaps a fuller realization of the true costs of landfilling as discussed above.

Table 1 also shows that the region's publicly owned landfills accept solid waste only from within a service area's boundaries. Except for the Orange County landfill, the region's publicly owned facilities will not accept USMA's solid waste. Of the privately owned facilities, only the Al Turi landfill will be open after 2 years. However, this landfill is currently accepting the maximum amount of solid waste allowed by its permit. Current contract or permit conditions would have to change to allow this landfill to accept USMA's solid waste. Information obtained from employees of the New Jersey and Connecticut State environmental offices reveals that, for the counties closest to USMA, there are currently no landfills capable of accepting USMA's solid waste.

USMA Landfill: Siting Issues

Siting a landfill at USMA to dispose of all the installation's solid waste would be difficult. USMA would require a small (20 ton/day) landfill to dispose of its solid waste. The New York DEC has a goal of reducing the number of landfills in the state to 100 by 1997. Furthermore, the DEC's goal is to keep the largest landfills in operation while closing the smaller, less efficient facilities. It is anticipated that the landfills that remain open will be used for the disposal of HRI ash and other solid waste that can not be burned. The DEC would undermine its own goals by issuing a permit for a small landfill to handle all USMA's solid waste.

The costs of a small landfill are generally high. The costs of siting, building, operating, and closing a landfill under the 1975 Resource Conservation and Reclamation Act (RCRA) can be conservatively estimated using the U.S. Environmental Protection Agency's (EPA) Design and Cost Model. For a 20 ton/day landfill, the model predicts overall costs of $40/ton (USEPA, 5 August 1988). The EPA has also published information for estimating the incremental costs of complying with the new Part 258 of RCRA (USEPA, 30 August 1988). The incremental costs for a 20 ton/day landfill are estimated to be $50/ton (USEPA, 5 August 1988). Therefore, the total cost for a 20 ton/day landfill complying with 40 CFR Part 258 would be approximately $90/ton.

Table 1

New York Landfills in Neighboring Counties

Facility	County	Operating Level (tpd)	Remaining Cap. (yrs)	Tipping Fee ($/t)	Outside Waste
Orange County	Orange	780	5*	60	No
Al Turi†	Orange	1400	5*	62	Yes
Clarkstown	Rockland	540	< 2	30	No
Haverstraw	Rockland	135	< 2	30	No
Patterson	Putnam	< 30	< 2*	30	No
Phillipstown	Putnam	< 30	< 2	30	No
Rhinebeck	Dutchess	< 30	< 2	< 30	No
Milan	Dutchess	< 30	< 2	< 30	No
Tivoli	Dutchess	< 30	< 2	< 30	No
Beckman	Dutchess	< 30	< 2	< 30	No
Stanford	Dutchess	< 30	< 2	< 30	No
Northeast	Dutchess	< 30	< 2	< 30	No
Union Vale	Dutchess	< 30	< 2	< 30	No
Pine Plains	Dutchess	< 30	< 2	< 30	No
Washington	Dutchess	< 30	< 2	< 30	No
Gardineer	Ulster	< 30	NA	NA	No
New Paltz	Ulster	< 30	NA	NA	No
Rosendale	Ulster	< 30	NA	NA	No
Plattekill	Ulster	< 30	NA	NA	No
Shawangunk	Ulster	< 30	5	30	No
Jockey Hill	Ulster	< 30	< 2	< 30	No
Esopus	Ulster	< 30	< 2	< 30	No
Lloyd	Ulster	< 30	< 2	< 30	No
Marlborough	Ulster	< 30	< 2	< 30	No
Saugerties	Ulster	< 30	< 2	< 30	No
Rochester	Ulster	< 30	< 2	< 30	No
Hurley	Ulster	< 30	< 2	< 30	No
Olive	Ulster	< 30	< 2	< 30	No
Ulster	Ulster	< 30	< 2	< 30	No
Woodstock	Ulster	< 30	< 2	< 30	No
Wawarsing	Ulster	< 30	< 2	< 30	No
Barnes†	Sullivan	< 30	< 2	NA	Yes
Bethel	Sullivan	< 30	< 2	< 30	No
Sullivan County	Sullivan	100	5*	30	No
Scarfield-Beck†	Sullivan	< 30	< 2	NA	Yes
Lumberland	Sullivan	< 30	NA	< 30	No
Mamakating	Sullivan	< 30	< 2	< 30	No

*Remaining capacity may be increased if future expansion of facility allowed by New York DEC.
†Denotes commercial landfill. All others listed are publicly owned.

Commercial Incinerators

A database developed by USACERL and the Government Refuse Collection and Disposal Association (GRCDA) was used to identify all commercial incinerator plants in an approximately three county area around West Point. This involved areas in New York, New Jersey, and Connecticut as illustrated in Figure 5. Pennsylvania was excluded because of its apparent political distaste for outside waste entering the state and its severe problems with siting incinerator plants. Figure 5 shows the approximate locations of the commercial incinerator plants relative to West Point—both existing HRIs and those in some stage of development.

The 36 incinerator plants identified in the targeted areas are listed in Table 2. However, four of these are industrial-type plants dedicated to their owners. Of the remaining 32 plants, 11 plants—one-third of these potentially available—are on indefinite hold due to financial, regulatory, or other obstacles and no specific completion dates are set. Another nine plants are either currently processing waste at their maximum capacity or are solely dedicated to specific users. Two are closed. This leaves only seven plants that could receive waste from West Point and three others that might be available. The tipping fees at the newer plants are all close to $100/ton. Therefore, it is reasonable to assume that if the USMA were to send its waste to a commercial incinerator, the fee would be $100/ton plus transportation costs. It should be noted that these incinerator tipping fees are competitive with rates now (or will soon be charged) at local landfills.

It is estimated that the transportation cost would be approximately $0.06/ton/mile (e.g., $6.00/ton to haul waste 100 miles). This figure is based on information provided by Waste Management, Inc. (WMI) using semi-trailer transfer trucks with an operating cost of $65/hour hauling 40 tons per load. If a smaller type of truck is used, the cost would be higher. The incinerator facility nearest West Point is the Westchester County plant in Peekskill, about 17 miles from USMA. Hauling waste to the Peekskill facility would only add about $1/ton to the plant's tipping fee of $80/ton. Although the plant is rated at 2250 TPD it will not accept any waste from outside the County. The next closest plant is the Dutchess County plant in Poughkeepsie, a trip of approximately 50 miles. This would add about $3/ton to the plant's tipping fee of $88/ton. The Poughkeepsie plant is small for a commercial facility at 400 TPD and reportedly operates almost at capacity. Another possibility might be to transport the waste 133 miles to the Army HRI plant at Fort Dix, NJ, which would cost approximately $8/ton plus about $70/ton tipping fee. The estimated tipping fee was based on Fort Dix operating costs, and should be considered on the high side. Improved utilization of Fort Dix's plant would probably lower the operating costs per ton of waste. This Fort Dix plant has four incinerators rated at 20 TPD. With one unit off line, the normal operating capacity is 60 TPD. Current capacity averages 35 TPD. According to the operating staff, the plant has an excess capacity of 10 to 20 TPD.

USMA Incinerator Plant

Table 3 lists weekly waste totals delivered to the USMA transfer station from 1982 through 1987. It shows an average of about 7014 tons per year, or, calculated separately, 134 tons per week (which totals 6968 annually). The larger total—7014 tons—was used for analysis. On 1 January 1990, the landfill tipping fee increased to $60 per ton, which may or may not remain in effect for the 5- to 7-year life of the current landfill extension. After that time, costs will be higher. Information on the disposal of medical waste which was also provided is discussed in later paragraphs and in Table 5. Information on energy costs was provided by USMA boiler plant personnel.

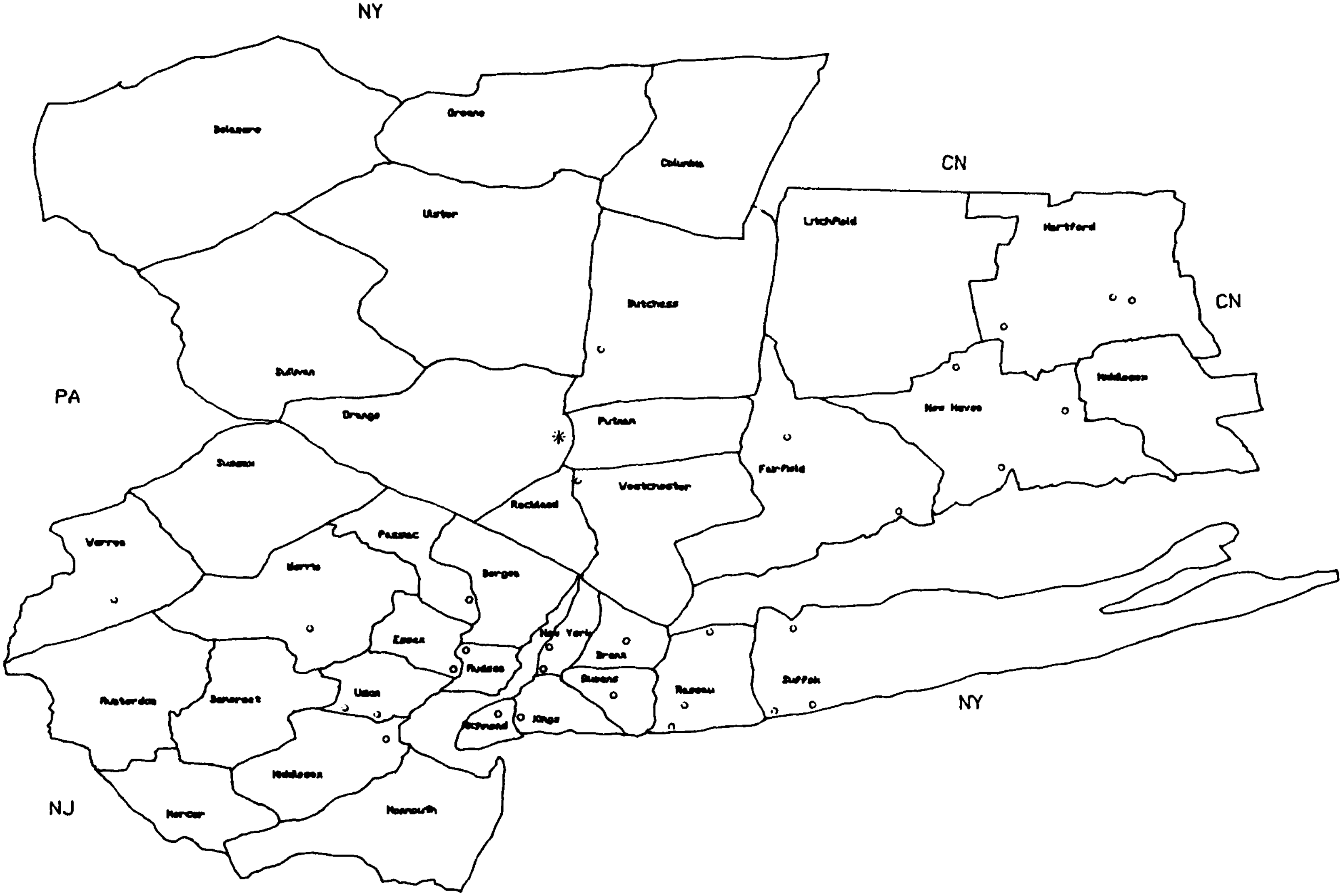

Figure 5. Commercial incinerator plants near USMA—existing or under development.

Table 2

Commercial Incinerator Plants

Facilities	City	County	State	Name	Phone	Operating	TPD	Tip
Danbury	Danbury	Fairfield	CT	Jackie Heneage	203-775-6256	Indef.	570	
Bridgeport-Signal	Bridgeport	Fairfield	CT	Lynne Heally	203-549-6390	JUL 88	2250	$53 Maybe
Mid-Connecticut	Hartford	Hartford	CT	Thomas Lenehan	203-549-6390	OCT 88	2000	$45 No Outside
Bristol	Bristol	Hartford	CT	Johnathan Bilmes	203-585-0419	MAY 88	650	$51 Maybe
Pratt & Whitney	E Hartford	Hartford	CT	John Murray	203-565-2016	--	24	Indust.
Wallingford	Wallingford	New Haven	CT	Dennis Martin	203-549-6390	SEP 89	420	$45 No Outside
Waterbury	Waterbury	New Haven	CT	Stephen Schwarz	914-694-2100	Indef.	360	
South Central	New Haven	New Haven	CT	Susan Whetstone	203-787-8278	Indef.	1000	
Bergen County	Richfield	Bergen	NJ	Nancy Macedo	201-641-2552	FEB 94	3000	$110
Newark	Newark	Essex	NJ	County PAO	201-621-6588	JUN 90	2277	$70 Full
Hudson County	Kearney	Hudson	NJ	Al Flori	201-795-4555	Mar 93	1500	?
Hunterdon County		Hunterdon	NJ	Teresa Martin	201-788-1110	Indef.	0	
Middlesex County	S. Amboy	Middlesex	NJ	Fred Kurtz	201-721-3800	JUL 93	2250	$80 No Outside
Morris County	Morristown	Morris	NJ	Glen Schweizer	201-285-8390	JUL 93	1348	$100
Somerset County		Somerset	NJ	John Horensky	201-231-7031	Indef.	700	
Sussex County		Sussex	NJ		201-383-6016	No	400	
Lockheed	Plainsfield	Union	NJ	John Marut	201-757-1600	--	12	Indust.
Union County	Rahway	Union	NJ	Joseph Kazar	201-351-8770	JAN 92	1500	$100
Warren County	Oxford	Warren	NJ	Tom James	205-272-8020	JUL 88	400	$99
Bronx	Bronx	Bronx	NY	Benjamin Miller	212-566-0922	Indef.	0	
Dutches County	Poughkeepsie	Dutches	NY	Scott Daniels	914-462-0334	JUN 87	400	$88 Almost Full
Columbia/Greene		Greene	NY	Roland Vosburgh	518-828-3375	Indef.	0	
Brooklyn Navy Yd	Brooklyn	Kings	NY	Benjamin Miller	212-566-0922	JUN 93	3000	$45 No Outside
Hempsted	Westbury	Nassau	NY	Al Albanese	516-378-4210	SEP 89	2000	$70 No Outside
Oceanside	Oceanside	Nassau	NY	Al Albanese	516-378-4210	Closed	750	
Oyster Bay	Oyster Bay	Nassau	NY	Karl Luepold	516-921-7347	JUL 92	1000	$104 Maybe
Manhattan	Manhattan	New York	NY	Benjamin Miller	212-566-0922	Indef.	0	
Columbia Pres. Hosp.	New York	New York	NY	Barbookles	212-305-2500	--	0	Indust.
Queens	Queens	Queens	NY	Benjamin Miller	212-566-0922	Indef.	1000	
Staten Island	Staten Isle	Richmond	NY	Benjamin Miller	212-566-0922	Indef.	0	
Macarthur Energy	Islip	Suffolk	NY	Charles Widener	516-224-5447	May 89	518	$40 Full
Glen Cove	Glen Cove	Suffolk	NY	Robert Mangan	516-676-4402	Yes	225	$85
Babylon	Babylon	Suffolk	NY	Frank Andracchi	516-491-1976	DEC 88	750	$78
Westchester-Resco	Peekskill	Westchester	NY	Charles Miles	914-285-2539	OCT 84	2250	$80 No Outside
Town of Brookhaven	Brookhaven		NY	Elaine McKibbin	516-451-6222	Indef.	0	
Corning Glass	Corning		NY	Rick Sadlowski	607-974-7748	--	0	Indust.

Table 3

USMA Weekly Waste Tonnages

1982	Tons	1983	Tons	1984	Tons	1985	Tons	1986	Tons	1987	Tons	AVERAGE
		1/1/83	64.11	1/7/84	85.60	1/5/85	53.15	1/4/86	68.64	1/3/87	66.72	
		1/8/83	82.38	1/14/84	138.67	1/12/85	120.05	1/11/86	125.15	1/10/87	111.74	
		1/15/83	126.23	1/21/84	130.14	1/19/85	128.21	1/18/86	117.98	1/17/87	122.02	
		1/22/83	109.94	1/28/84	128.14	1/26/85	124.00	1/25/86	120.60	1/24/87	102.61	
		1/29/83	127.26	2/4/84	136.70	2/2/85	127.70	2/1/86	130.25	1/31/87	120.57	
		2/5/83	120.40	2/11/84	152.12	2/9/85	117.65	2/8/86	126.35	2/7/87	115.33	
		2/12/83	130.37	2/18/84	162.71	2/16/85	134.63	2/15/86	122.28	2/14/87	109.02	
		2/19/83	131.08	2/25/84	118.32	2/23/85	107.22	2/22/86	119.72	2/21/87	94.47	
		2/26/83	115.90	3/3/84	119.23	3/2/85	132.08	3/1/86	117.53	2/28/87	119.76	
		3/5/83	124.99	3/10/84	122.39	3/9/85	124.18	3/8/86	126.43	3/7/87	124.25	
		3/12/83	134.27	3/17/84	95.33	3/16/85	109.72	3/15/86	111.03	3/14/87	104.33	
		3/19/83	120.99	3/24/84	124.06	3/23/85	120.22	3/22/86	144.27	3/21/87	122.87	
		3/26/83	134.12	3/31/84	120.05	3/30/85	138.24	3/29/86	138.01	3/28/87	132.10	
		4/2/83	128.30	4/7/84	131.92	4/6/85	124.50	4/5/86	130.49	4/4/87	129.45	
4/3/82	39.20	4/9/83	130.54	4/14/84	149.48	4/13/85	136.25	4/12/86	134.65	4/11/87	123.00	
4/10/82	117.37	4/16/83	138.79	4/21/84	138.04	4/20/85	134.04	4/19/86	148.76	4/18/87	145.98	
4/17/82	128.50	4/23/83	154.42	4/28/84	123.46	4/27/85	141.24	4/26/86	139.04	4/25/87	132.47	
4/24/82	146.60	4/30/83	158.68	5/5/84	186.96	5/4/85	149.31	5/3/86	146.79	5/2/87	154.57	
5/1/82	153.98	5/7/83	139.95	5/12/84	164.65	5/11/85	157.47	5/10/86	139.08	5/9/87	133.50	
5/8/82	143.18	5/14/83	156.25	5/19/84	184.68	5/18/85	177.20	5/17/86	149.38	5/16/87	147.40	
5/15/82	138.89	5/21/83	165.37	5/26/84	201.29	5/25/85	197.17	5/24/86	182.67	5/23/87	184.18	
5/22/82	185.75	5/28/83	212.71	6/2/84	130.97	6/1/85	99.32	5/31/86	179.46	5/30/87	183.87	
5/29/82	182.20	6/4/83	111.81	6/9/84	121.52	6/8/85	117.27	6/7/86	116.13	6/6/87	118.25	
6/5/82	103.74	6/11/83	122.21	6/16/84	123.05	6/15/85	106.55	6/14/86	118.82	6/13/87	119.23	
6/19/82	118.08	6/18/83	122.39	6/23/84	116.14	6/22/85	112.28	6/21/86	125.68	6/20/87	118.29	
6/26/82	115.38	6/25/83	117.93	6/30/84	126.20	6/29/85	130.27	6/28/86	125.09	6/27/87	124.37	
7/3/82	122.33	7/2/83	132.60	7/7/84	142.89	7/6/85	154.79	7/5/86	141.29	7/4/87	104.83	
7/10/82	147.05	7/9/83	135.62	7/14/84	174.05	7/13/85	137.68	7/12/86	144.50	7/11/87	173.32	
7/17/82	125.15	7/16/83	133.38	7/21/84	153.31	7/20/85	148.56	7/19/86	160.98	7/18/87	158.22	
7/24/82	139.80	7/23/83	136.62	7/28/84	159.45	7/27/85	147.05	7/26/86	139.30	7/25/87	147.07	
7/31/82	127.16	7/30/83	133.75	8/4/84	142.49	8/3/85	164.83	8/2/86	157.09	8/1/87	157.86	
8/7/82	140.81	8/6/83	144.93	8/11/84	144.66	8/10/85	162.47	8/9/86	154.77	8/8/87	165.68	
8/14/82	179.00	8/13/83	142.56	8/18/84	179.15	8/17/85	170.39	8/16/86	154.18	8/15/87	168.43	
8/21/82	126.30	8/20/83	180.12	8/25/84	149.86	8/24/85	158.28	8/23/86	182.51	8/22/87	176.02	
8/28/82	144.43	8/27/83	135.11	9/1/84	160.80	8/31/85	135.22	8/30/86	146.42	8/29/87	145.67	
9/4/82	131.22	9/3/83	144.32	9/8/84	132.79	9/7/85	133.61	9/6/86	116.73	9/5/87	168.96	
9/11/82	105.32	9/10/83	125.86	9/15/84	136.96	9/14/85	146.94	9/13/86	132.25	9/12/87	148.31	
9/18/82	132.29	9/17/83	128.57	9/22/84	154.49	9/21/85	154.23	9/20/86	142.12	9/19/87	190.74	
9/25/82	124.95	9/24/83	128.06	9/29/84	153.54	9/28/85	156.72	9/27/86	116.57	9/26/87	150.19	
10/2/82	141.16	10/1/83	132.58	10/6/84	125.80	10/5/85	155.71	10/4/86	125.80	10/3/87	131.34	
10/9/82	142.44	10/8/83	137.14	10/13/84	132.71	10/12/85	161.22	10/11/86	107.76	10/10/87	167.51	
10/16/82	120.06	10/15/83	132.33	10/20/84	144.27	10/19/85	141.43	10/18/86	140.13	10/17/87	125.50	
10/23/82	125.94	10/22/83	120.74	10/27/84	146.88	10/26/85	130.96	10/25/86	150.06	10/24/87	156.43	
10/30/82	136.00	10/29/83	140.24	11/3/84	156.00	11/2/85	151.17	11/1/86	113.73	10/31/87	152.29	
11/6/82	123.80	11/5/83	129.18	11/10/84	153.61	11/9/85	140.45	11/8/86	136.53	11/7/87	141.50	
11/13/82	137.51	11/12/83	109.19	11/17/84	128.79	11/16/85	136.50	11/15/86	141.50	11/14/87	130.62	
11/20/82	133.15	11/19/83	139.31	11/24/84	107.32	11/23/85	152.52	11/22/86	131.38	11/21/87	1 47.65	
11/27/82	113.77	11/26/83	115.62	12/1/84	117.76	11/30/85	120.28	11/29/86	121.32	11/28/87	108.76	
12/4/82	114.09	12/3/83	117.48	12/8/84	119.16	12/7/85	120.41	12/6/86	126.41	12/5/87	123.68	
12/11/82	121.63	12/10/83	129.69	12/15/84	134.23	12/14/85	123.50	12/13/86	112.57			
12/18/82	117.65	12/17/83	135.75	12/22/84	121.94	12/21/85	131.10	12/20/86	139.68			
12/25/82	70.93	12/24/83	112.55	12/29/84	88.34	12/28/85	72.08	12/27/86	85.75			
		12/31/83	74.17									
Total			6908.72		7192.98		7027.90		6925.49			7013.77*
Average	129.65		130.35		138.33		135.15		133.18		136.75	133.90**
Minimum	39.20		64.11		85.60		53.15		68.64		66.72	62.90
Maximum	185.75		212.71		201.29		197.17		182.67		190.74	195.05
Std Dev.	25.70		22.48		23.53		24.30		20.77		25.93	23.78

*Annual average calculated for full years 1983 through 1986.
**Weekly average calculated from 3 April 1982 through 5 December 1987.

Currently, USMA pays $0.55/gal for No. 5 fuel oil and $3.80/1000 cu ft of natural gas. The laundry boiler plant operates on gas and the main boiler plant operates on oil. The combined seasonal steam load from these two plants is 22,000 lb/hr, with approximately half coming from each plant. The current average cost of electricity, including demand charges, is $0.09/kWh. Another study, being performed by USACERL, has developed several alternatives for meeting the USMA's future thermal and electrical energy needs (*Energy Supply Alternatives for the Year 2002 at the U.S. Military Academy (USMA),*" Draft USACERL Technical Report, M. Lin et al., May 1993).

The study showed a moderate increase in peak steam demand from 210,000 lb/hr to 221,000 lb/hr (including the laundry boiler plant), which would have little effect on the seasonal load. The lowest-cost alternative was to refurbish the existing power plant with new high-pressure gas/oil boilers and new steam turbine generators. Because the potential for heat recovery incineration was not great, the study did not consider the availability of steam from an incinerator plant. If an HRI becomes viable, then it \should be incorporated into the alternative selected in the energy supply study. The effect of the HRI would be to reduce the size of the boilers needed, or possibly improve the economics of using absorption chillers.

The energy cost figures provided were entered into the USACERL HRI feasibility computer program (HRIFEAS) to analyze the technical and economic potential for an incinerator project at West Point. The data were analyzed for the cases of a small HRI plant serving only the needs of USMA with and without flue gas scrubbing equipment, with a new tipping fee of $60 per ton, and for a possible future tipping fee of $100 per ton. HRIFEAS was also used to determine the size of plant required to meet the 22,000 lb/hr minimum steam demand and its economic viability at both the $60 per ton and $100 per ton tipping fees. It was assumed that flue gas scrubbing equipment would definitely be required for this plant size, which would be built by a third-party contractor. The detailed printouts from the HRIFEAS analysis are included in Appendix A.

The HRI feasibility program used for the analysis of the data is being developed as part of USACERL's HRI standard design package. HRIFEAS prompts the user to input the required disposal and energy information, provides default values if the information is not known, flags values that seem unreasonable, provides technical design and cost information, and interfaces with the USACERL-developed Life Cycle Cost in Design (LCCID) program for the economic analysis. HRIFEAS determined the optimum economic size of the plants, including the number of incinerator units, based on USMA's waste generation rate, an assumed operating schedule of 7 days a week, and one redundant unit for backup.

The LCCID program automates life cycle cost analysis and comparative economic evaluation of construction alternatives. Since HRIFEAS drives LCCID, the user need not be familiar with the LCCID input. The appropriate economic criteria, including Department of Energy (DOE) fuel price escalation rates and present worth calculations, are included in the LCCID. The program calculates the life cycle cost of each alternative (in this case, continuing commercial landfilling versus building an HRI plant), the savings-to-investment ratio (SIR), and the discounted payback period (DPP). The output from the two programs can be used to prepare the Project Development Brochure and DD Form 1391. (Additional information on LCCID can be found in USACERL Technical Report E-85/07, *Development and Use of the Life Cycle Cost in Design Computer Program [LCCID].*)

The information passed to LCCID includes an estimate of the HRI plant capital construction cost, the plant O&M cost, amount and cost of auxiliary fuel used, amount and cost of electricity consumed, the amount and value of reduced fuel consumption (assuming full use of the HRI's steam produced to meet USMA's heat needs), and an estimate of savings that would accrue by avoiding the county landfill tip fee. A recent refinement in HRIFEAS enables the program to produce a rough estimate of new landfill construction costs that would arise in cases where the landfill's life expectancy is less than 15 years. Since the life cycle of an HRI is defined as 15 years by the U.S. Army Corps of Engineers (USACE), total landfill costs must be projected over that period of time to constitute a valid life-cycle cost comparison between an HRI and a landfill. In the case of USMA, however, the life of the landfill was assumed to be 15 years because the Academy uses offsite commercial disposal. A landfill's construction costs are built into its service fee, so the fees USMA pays to any and all offsite commercial landfills over 15 years would include construction costs.

The HRI cost estimates are based on a typical modular starved air incinerator arrangement as illustrated in Figure 6, with and without supplementary air pollution control equipment. This system uses a modular dual chamber incinerator, with the first, or primary chamber operating under substoichiometric (starved air) conditions. The secondary chamber operates under excess air conditions, completes the combustion of the gases from the primary chamber, and destroys most potential pollutants. Under the current regulations in most states, no additional air pollution control equipment would be needed. However, regulations in New York would require additional equipment, primarily an acid gas scrubber.

The results of the USMA HRIFEAS analysis, listed in Table 4, show that a small incinerator plant with a total installed capacity of 30 TPD (three 10 TPD units) would be economically viable if flue gas scrubbing is not required. New legislation in the State of New York would require scrubbers on virtually any size of incineration equipment (Codes, Rules and Regulations of the State of New York, Title 6, Chapter III.219-2). The additional capital and operating cost of this equipment would reduce the SIR to less than 1, lengthen the payback period to more than 15 years, and render any such project economically unviable at disposal costs of $100/ton or less. However, if the effective waste disposal costs significantly exceed $100/ton, either because of higher landfill tipping fees or the inclusion of medical waste, the plant would be economically viable. A parametric analysis was also done to show how escalating landfill costs affect the SIR and DPP (Figure 7).

Limited data on the amount of medical waste generated and the cost to dispose of it were developed in a 1987 study (Gallo). If the waste generation data for 25 days in February are taken as typical, the annual generation rate is 129.2 tons. If the same amount of waste is generated in Fiscal Year (FY) 91, the contract cost to dispose of it would be $1090.64/ton (Table 5). Combining the future cost of municipal waste disposal and the FY91 cost of medical waste disposal for analytical purposes, the effective total waste disposal cost becomes $117.92/ton. The analysis indicates that the amount of medical waste is small enough that the plant size would remain the same, but the SIR becomes 1.2 and the DPP becomes 12 years as a result of greater waste disposal savings. For example, under current (May 1992) New York State air pollution control laws, infectious waste incinerators are limited to particulate emissions of 0.015 gr/dscf, while municipal and private solid waste incinerators are limited to 0.01 gr/dscf and hydrogen chloride emission standards are equal. There are no earlier municipal solid waste dioxide emission standards, but infectious wastes are limited to 150 ppm (hourly average). It should be pointed out that the weight information developed in this study is very meager; additional weighings should be done.

Third Party Incinerator Plant

The analysis of a hypothetical third party plant in Table 4 indicates that the 22,000 lb/hr minimum steam demand for the entire installation could support a plant burning 115 TPD. The hypothetical plant was sized on this basis because any third party contractor would require a take-or-pay arrangement for a certain minimum amount of steam. The plant would consist of four 40 TPD units and be rated at 120 TPD based on one redundant unit and operation 7 days a week. Both 115 TPD cases analyzed in Table

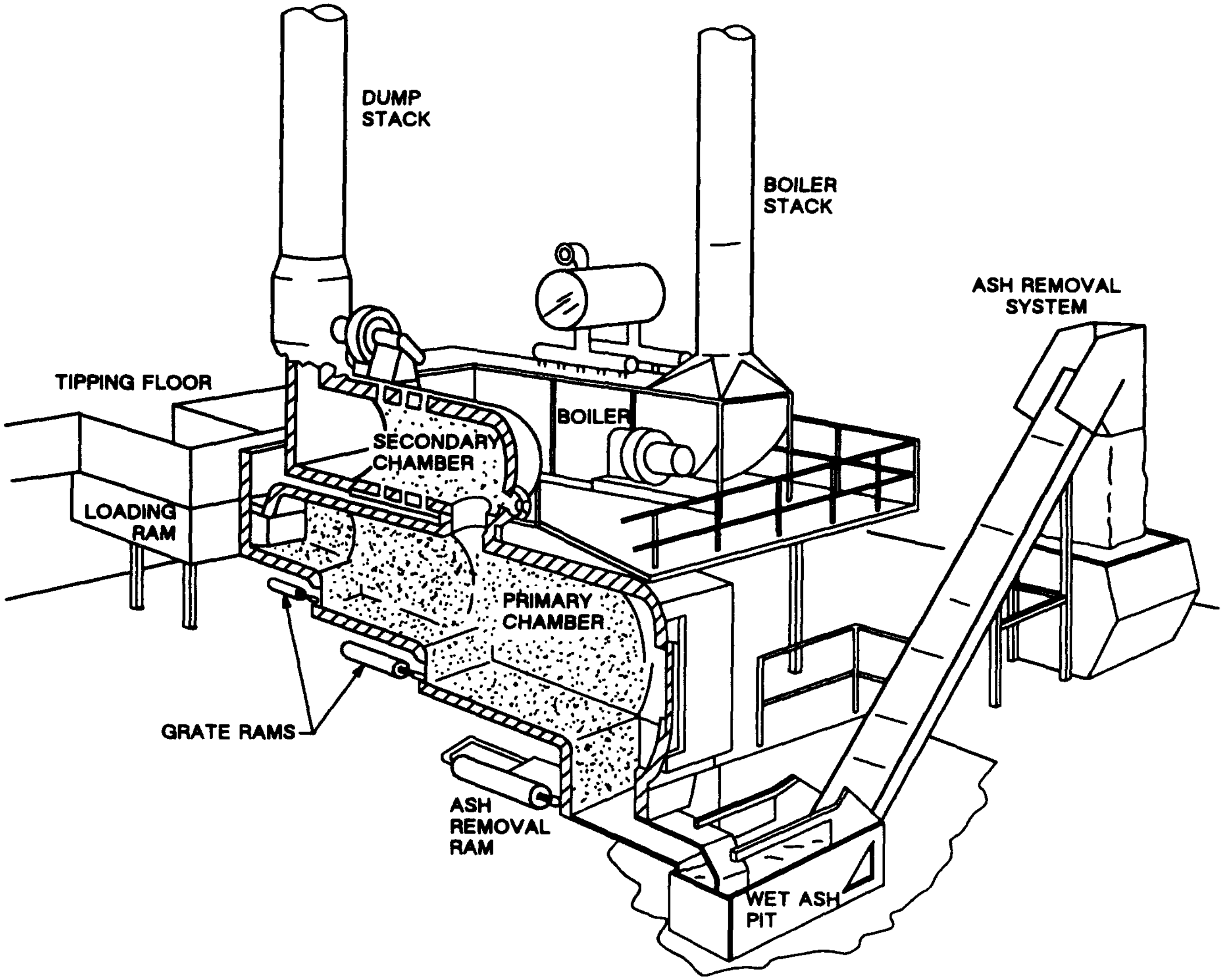

Figure 6. Typical starved air incinerator.

4 included flue gas scrubbing equipment. At a tipping fee of $50/ton, the plant is not quite economically viable at an SIR of 0.9. However, at a tipping fee of $100/ton, the plant has a healthy SIR of 1.8 and a 6-year payback period. It should be noted that a third party contractor would probably be willing to build a somewhat larger plant based on selling more steam (above the take-or-pay level) during most of the year and possibly generating electricity to sell to the local utility. This information has been shared with several potential third party contractors. Their responses expressing interest in a potential plant at West Point, including possible medical waste disposal, are printed in Appendix B.

There would be a number of advantages to building a third party plant at USMA. Chief among these is that all liabilities for obtaining additional waste and environmental permits would be the responsibility of the contractor. The contractor could also initiate court suits to force the State and/or Orange County to issue permits if the project is in compliance with standing laws and regulations. Complaints and allegations about environmental emissions would also be the responsibility of the contractor. USMA's primary obligations would be to purchase the energy produced and provide the land for the plant for the duration of the contract (normally 25 years). The main risk to USMA is the investment of $75K to $125K to have Huntsville Division write the "third party" solicitation. If there were no responses to the solicitation, or the selected contractor fails, that money would be lost.

Table 4

Results of HRIFEAS Analysis for USMA

Size (TPD)	Scrubber	Capital Cost	Tip Fee	Landfill Savings	Fuel Savings	SIR	DPP
30	No	$1,885,010	$60	$252,504	$118,550	1.1	13
30	Yes	$2,313,435	$60	$201,582	$92,492	0.5	>99
30	No	$1,885,010	$100	$420,840	$118,550	1.7	6
30	Yes	$2,313,435	$100	$335,971	$92,492	0.9	20
30**	Yes	$2,313,435	$118	$403,463	$94,193	1.2	12
115*	Yes	$8,081,452	$50	$1,002,547	$640,301	0.9	>99
115*	Yes	$8,081,452	$100	$2,005,094	$640,301	1.8	6

*Third party plant
**Medical waste included

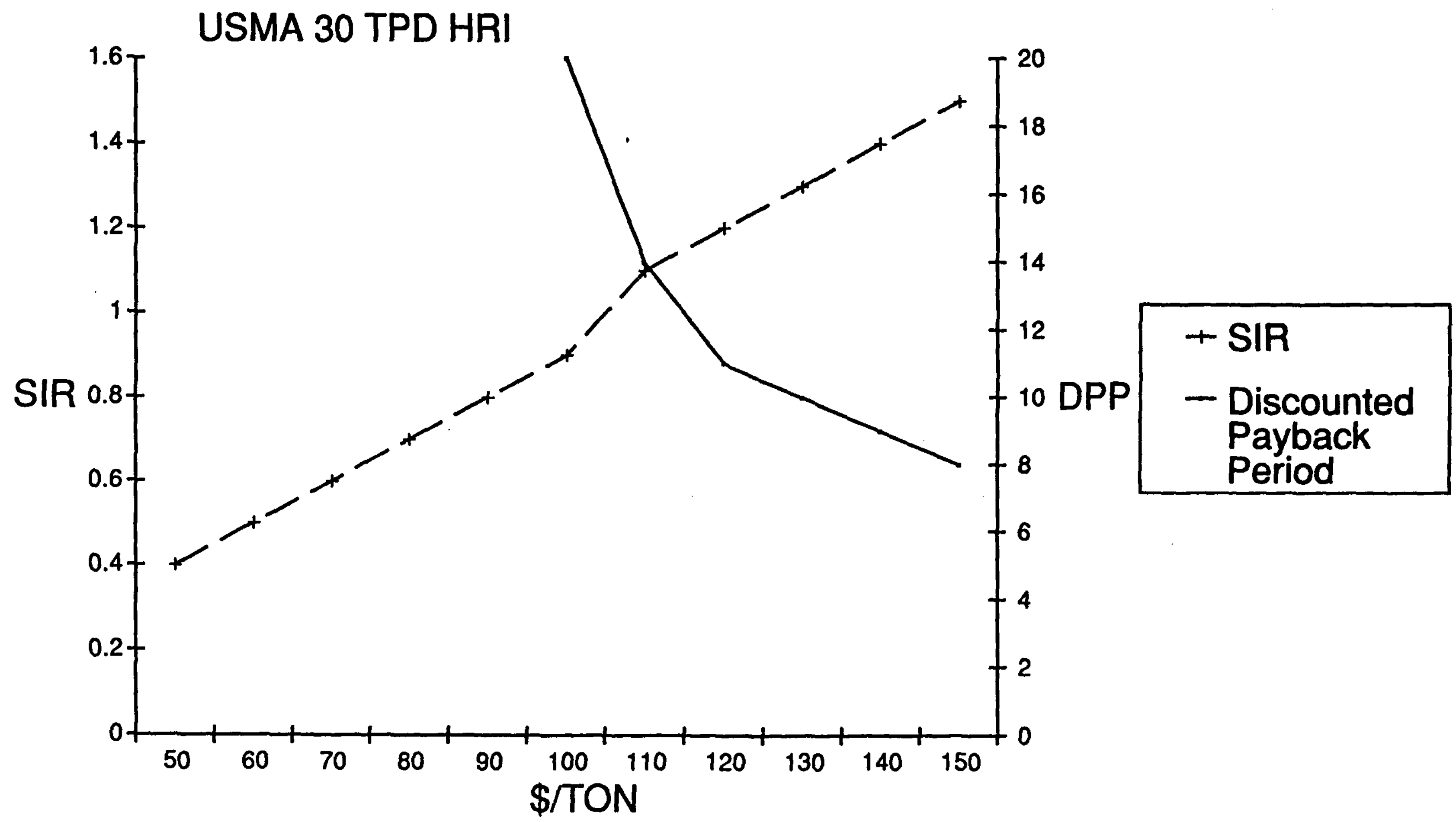

Figure 7. Economic effect of tipping fee on SIR and DPP for theoretical USMA incinerator.

Table 5

USMA Medical Waste

1 Feb 87 - 25 Feb 87	= 17,701 lb/25 days
	= 708 lb/day
Waste Produced Annually	= 708 lb/day x 365 days
	= 258,435 lb/year
	= 129.2 ton/year
FY91 Projected Disposal Cost	= $140,911.00
	= $1,090.64/ton

Combined Waste Disposal Cost

	Tons	Cost
Regular Waste at $100/ton	7,014	$701,400
Medical Waste at $1,090.64/ton	129	$140,911
	-----	--------
TOTAL	7,143	$842,311

$117.92/ton

Concern has been expressed about whether enough waste would be brought up the steep roads to an HRI at West Point. Table 6 shows that approximately 200 TPD of waste could be obtained within a 15-mile map radius of West Point. This estimate is based on the populations of the towns and townships listed and the average New York State waste generation rate, which is higher than the national average. Implementation of a vigorous recycling program is expected to reduce these amounts by the Government-mandated target of 25 percent (approximately). It should also be noted that the third party contractors identified in Appendix B are especially interested in disposing of medical waste because of the potential for very large profits. This profit potential also makes it easy to provide savings large enough to induce waste generators to use the USMA incineration facility. In addition, the North Metropolitan Hospital Association has expressed great interest in having a third party plant at West Point to burn medical waste.

Table 6

Sources of Wastes in USMA Area

Community	**1990 Population**	**Tons Per Week**	**Tons Per Day**	**Map Miles Distance**
Highland (T)	14,400	324	46	4
Highland Falls (V)	4,400	99	14	2
Woodbury (T)	7,900	178	25	10
Cornwall (T)	11,800	266	38	5
Cornwall-Hud. (V)	3,400	77	11	4
Blooming Grove (T)	14,330	322	46	12
Monroe (V)	7,700	173	25	12
		TOTAL	205	

Data source: New York Department of Commerce
NOTE: Waste generation rate based upon NY State average of 7.5 lb/person/day, 6 days/week. Average HRI daily capacity based on operation 7 days a week.

Recycling Considerations for USMA

It is the authors' opinion that Orange County cannot directly enforce its recycling laws and mandates on USMA. However, the County can restrict what goes into its landfill and indirectly force recycling on West Point with fines on paper, aluminum, and other recyclable materials found in USMA's solid waste. USMA would have the option of sending the waste elsewhere. This could be an attractive option if the County raises tipping fees to subsidize recycling or as a result of underestimating landfill O&M costs.

If the County is going to impose restrictions on materials that can be landfilled it should also help to develop alternate disposal outlets. For aluminum, the problem may already be mostly solved by the State's aluminum can deposit law. USMA should be sure that the commissary, post exchange (PX), and other stores are accepting empty cans and handling them like the commercial establishments. If the cadets are reluctant to go to a store to return empty cans, receptacles could be provided in the dorms and other student areas. When full, they could be emptied by cadets; the cash proceeds from recycling could be deposited in the cadet morale support fund. Paper will be more difficult to recycle due to the current market glut. Stronger markets are developing for other materials, such as plastics and segregated glass.

Participation in the County recycling program may offer certain advantages such as:

1. Access to County recycling facilities such as drop-off centers and composting sites.

2. Access to the markets for recyclables that the County has developed. The County would be responsible for providing adequate markets for recyclables turned in by USMA, so the Academy would not be perceived to be competing with the surrounding communities for its share of the limited recyclables market.

Source-separated recyclables should normally be taken from local collection centers directly to the facility that will actually reuse them. Regional transshipment centers should only be used if the material must be transported a long distance to its market location. Handling of recyclables must be minimized to keep the costs down.

As an integral part of recycling, efforts should be made to "close the loop" and establish programs to buy products made from recycled materials. This may be somewhat difficult for USMA since most paper is usually purchased through the General Services Administration (GSA). Failure to close the loop is a major reason why there is currently a glut of used paper and other materials in the Northeast.

All U.S. experience to date shows that the Orange County recycling goal of 42 percent by the general population is unrealistic. This goal is based on figures from Japan, where there is a much higher percentage of easily recyclable materials in the waste stream. There also have been indications in the literature that this figure is somewhat inflated (Levenson and Wagner 1990). Recycling is also more economically attractive in Japan where the scarcity of natural resources makes reusing materials a necessity. The USEPA recently set a national recycling goal of 25 percent by 1992. However, EPA officials say that going much beyond 25 percent on a national basis is probably not possible in the foreseeable future. This is partly due to the inherent technical limitations, marketing problems, and other difficulties in recycling certain materials, and partly to the upper limit of participation in any effort depending on individual motivation and volunteerism (Thomas 1988). Some areas of the country may do better than 25 percent, but probably not 17 percentage points better. Many changes need to be made in our society in order to even come close to 42 percent recycling. If USMA commits to a recycling goal, it should be based on the total amount of recyclable materials available (including what is currently recycled), the contribution of these materials to the total waste stream, the ability to recover these materials, and the marketability of the materials.

Source separation is always a more efficient way to segregate recyclable materials than sorting them out of the waste stream at an MRF. Source separation should be easy to accomplish in USMA offices, academic buildings, and cadet housing areas. The staff residential areas will probably need some command emphasis, and curbside pickups may become necessary. Providing marked storage containers will help promote source separation in all cases.

USMA Recycling Efforts

West Point will be setting up some drop-off points in three locations using containers being provided free of charge by All Waste, Inc. All Waste is providing these as a 1-year experiment. The company is also experimenting with curbside pickup. Concern has been expressed as to whether this experiment will last and what will happen to the recycling effort afterward.

The collection container for glass will have three compartments: one each for clear, amber, and green glass. Another container will be provided for paper.

There has been some discussion of building a ramp at the transfer station so collection trucks could unload into roll-on/roll-off (RORO) containers. It was noted that, in regard to paper, USMA purchases 120 lb/cadet/year with a population of approximately 4400 cadets (264 ton/year).

Recycling can be an important part of a solid waste management plan. The decisions on how to recycle should be based on an economic analysis that compares the costs of operating a recycling plan to the savings on tipping fees and the revenues generated by the sale of recyclables. Tipping fees will continue to rise in the next few years as available landfill space is used up, and complying with stricter environmental regulations will greatly add to the cost of developing new landfills. At the same time, revenues may actually decrease as more recyclables enter the market. Some recyclables could become more valuable as a fuel source for an HRI than as a reusable resource if the cost of recycling becomes equal to or exceeds the landfill disposal cost.

Composting of yard waste and sewage sludge can be an important adjunct to a recycling program, but the capital cost of equipment and labor to do this must be balanced against the avoided disposal costs and any revenues generated. Composted material would be difficult to sell for agricultural purposes if there were any fears that the material may have been contaminated with heavy metals. However, this material can be used for daily landfill cover, and could be sold for that purpose.

3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. The tipping fee of $60/ton at the county landfill is very inexpensive compared with other solid waste disposal options in the area at this time. However, large increases in the fee should be expected soon—especially when a new landfill is opened.

2. Most of the commercial incinerator plants with lower tipping fees (less than $90/ton) are for local use only or are already accepting as much waste as they can process.

3. After the current landfill extension is closed in 5 to 7 years, the tipping fee at a new extension or a county incinerator will most probably be $100/ton or more.

4. An incinerator plant to burn only USMA's normal waste would not be economically viable due to the requirement for acid gas scrubbers. If the incinerator could also burn medical wastes, the savings would offset the cost of the scrubbers and make the plant economically viable. However, it may be difficult to get a permit due to public opposition.

5. A third party HRI plant does appear to be an economical alternative after tipping fees rise to $100/ton.

6. USMA may come under significant pressure from the County Government to recycle wastes to the maximum extent possible. This would come not through direct enforcement of County laws on USMA, but indirectly, through restrictions on what may be landfilled in the County.

7. Orange County seems to be following a path very similar to Burlington County in New Jersey, where Fort Dix and its HRI are located. At some point in the future, after difficult landfill siting problems and further increases in waste disposal costs, a county incineration facility will probably be constructed. This most probably would be a fluidized bed combustor (FBC) to burn the RDF and/or compost.

Recommendations

1. Continue using the county landfill for the next 5 years. At present this is the most economical option. This will also allow USMA time for more detailed planning and implementation of the most economical option for waste disposal after the current landfill extension closes.

2. Recycle as much material as warranted by the cost of gathering and disposing of the material as compared to the avoided landfill costs. Combine efforts with Orange County for the marketing and disposal of the material. However, be prepared to independently market the material if costs associated with the combined effort become excessive.

3. Develop alternatives to the use of Orange County facilities for the disposition of recyclable materials and waste. In addition to independent marketing of recyclable materials, alternatives would include shipping wastes to commercial incinerator plants or the plant at Fort Dix when Orange County disposal costs exceed $100/ton. This approach would give USMA flexibility and some degree of control over its own waste disposal situation instead of being completely subject to political decisions made at the County level.

4. USMA should positively consider a third-party incinerator plant for West Point if it is not strongly opposed by Orange County and if a decision is made to build a new central energy plant. The decision to prepare a solicitation for a third-party plant should be based on an evaluation of whether any contractors could successfully obtain permits and meet possible court challenges.

5. At present, the most appropriate site for a third-party incinerator plant appears to be near the base laundry. An alternate site would be behind the new commissary near Stoney Lonesome Gate. Both areas are being discussed as a possible site for a new fossil-fuel central boiler plant. The first site is near the edge of the base with access by Storm King Highway (State Route 218). The second site is directly accessible from both Route 218 and Route 9W. Either of these locations would be compatible with the heat distribution system if the new central boiler plant is built at the same site and includes a utility corridor link to the proposed HRI. The size and location of the plant should be coordinated with the base energy study being done by USACERL, as well as the plans of the County. This approach should be compared with the Government alternative of shipping the waste to the HRI at Fort Dix.

6. Consider building a USMA-owned incinerator plant for both regular and medical waste only as a last resort. This decision should be based on an overwhelming economic necessity and failure of the private sector to adequately respond to the waste disposal problem.

A number of issues beyond the scope of this study must be carefully considered in any discussions on building an HRI. Although some type of incinerator plant appears to be the best future waste disposal option, USMA must consider whether such a plant could fit into the historic aesthetics of West Point. Suitability of potential sites must also be examined, including access by truck traffic and the relationship to other activities at USMA (e.g., football games). Also, as previously discussed, compatibility with future base energy needs must be considered.

The findings of this study provide guidance toward the most economically effective direction for waste disposal at USMA. However, many considerations that will ultimately affect USMA's decisions about building an HRI have not been finalized. These considerations include whether New York State regulations allow cofiring MSW and medical wastes in the same incinerator; whether the region of location will object to an MSW/medical waste HRI; and whether the process will even work. Cost must also be considered.

METRIC CONVERSION FACTORS

1 lb	=	0.453 kg
1 ton	=	907.1848 kg
1 cu ft	=	0.028 m^3
1 mi	=	1.61 km
1 gal	=	3.78 l

REFERENCES

40 Code of Federal Regulations (CFR) 259; 54 Federal Register (FR) 12371, *EPA Standards for Tracking and Managing Medical Wastes* (USEPA; amended by 54 FR 24311, 6 June 1989; 54 FR 35190, 24 August 1989; and 55 FR 27231, 2 July 1990).

53 FR 33314, *EPA Proposed Regulations to Revise RCRA Criteria for Municipal Solid Waste Disposal Facilities and Practices* (U.S. Environmental Protection Agency, 30 August 1988).

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ABBREVIATIONS

DEC	New York State Department of Environmental Conservation
DPP	discounted payback period
EPA	Environmental Protection Agency
FBC	fluidized bed combustor
FY	Fiscal Year
GRCDA	Government Refuse Collection and Disposal Association
GSA	General Services Administration
HRI	heat recovery incinerator
HRIFEAS	Heat Recovery Incinerator Feasibility
LCCD	Life Cycle Cost in Design
MCA	Military Construction, Army
MRF	materials recovery facility
MSW	municipal solid waste
NSWMA	National Solid Waste Management Association
O&M	operations and maintenance
OCE	Office of the Chief of Engineers
PX	post exchange
RCRA	Resource Conservation Recovery Act
RDF	refuse-derived fuel
RORO	roll-on/roll off
SIR	savings-to-investment ratio
STOP	save that office paper
TPD	tons per day
USMA	U.S. Military Academy
WMI	Waste Management, Inc.

APPENDIX A: HRIFEAS Analysis Output

Session Number: 1

SUMMARY OF INPUTS	
INSTALLATION NAME:	US Military Academy
REGION:	2
WASTE TYPE:	2
HEAT CONTENT:	4500
*WASTE QUANTITY:	7,014 tpy
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$60.00/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
TONS PER 7 DAY WEEK OF WASTE:	135 tons/week
INDIVIDUAL INCINERATOR CAPACITY:	10 tons
NUMBER OF INCINERATORS REQUIRED:	3
TOTAL FACILITY CAPACITY:	30 tons/day
CAPITAL COSTS:	$62,834/ton
APC CAPITAL COST:	$0/ton
HRI CONSTRUCTION COSTS:	$1,885,010
O&M COSTS:	$25/ton
HRI O&M COSTS:	$175,350/year
LANDFILL SAVINGS:	$252,504/year
HEAT PRODUCTION:	32,436 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$148,970.86/yr
YEARLY AUXILIARY FUEL COSTS:	$6,432.09/yr
YEARLY AUXILIARY FUEL QUANTITY:	1,745 MBtu/yr
YEARLY ELECTRICITY COSTS:	$23,989.21/yr
YEARLY ELECTRICITY QUANTITY:	910 MBtu/yr
NET FUEL SAVINGS:	$118,550/yr

** NOTE: MBtu means MILLIONS of Btu's.

STEAM SUPPLY SUMMARY

Total Amount of Steam Produced:	32,436 MBtu/year
Yearly Amount of Steam Produced:	32,435,562 lb/year
Daily Amount of Steam Produced:	89,109 lb/day
Hourly Amount of Steam Produced:	3,713 lb/hour

AUXILIARY FUEL REQUIREMENTS

Auxiliary Fuel Type:	natural gas
Fuel Requirements:	1,745 MBtu/year
Yearly:	1,693 Kcuft/year
Daily:	4.65 Kcuft/day
Hourly:	0.19 Kcuft/hour

OPERATING SCHEDULE SUMMARY

Incinerator Operation:	7 days/week 3 shifts/day
Daily Operation:	24 hours/day
Weekly Operation:	168 hours/week
Yearly Operation:	8736 hours/year
Effective Steaming Time:	24 hours/day

REFUSE DISPOSAL SUMMARY

Total Weight Disposed:	7,014 tons/year 135 tons/week 19 tons/day
Total Volume Disposed:	29,689 cuy/year

DISPLACED FUEL SUMMARY

Displaced Fuel Type:	residual oil
Amount Displaced:	40,544 MBtu/year
	270,856 gallons/year 744 gallons/day 31.00 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 01-01-80 21:24:16
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALT ID.	ALTERNATIVES ANALYZED DESCRIPTION/TITLE	LCC (NET PW) ($ X 10**3)	INITIAL COSTS++ ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**6 BTUS)
A	LANDFILL	2329	0	40544
B	HRI	2222	1247	910

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

++ INCLUDES PRE-BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	1118	1212	0	0	0	2329
B	1247	134	842	0	0	0	2222

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

LCCID 1.035 DATE/TIME: 01-01-80 21:24:16
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DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	1247	-984	-370	0	0	0	-107	1.1	13

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

Session Number: 1

SUMMARY OF INPUTS	
INSTALLATION NAME:	US Military Academy
REGION:	2
WASTE TYPE:	2
HEAT CONTENT:	4500
*WASTE QUANTITY:	7,014 tpy
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$60.00/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
TONS PER 7 DAY WEEK OF WASTE:	135 tons/week
INDIVIDUAL INCINERATOR CAPACITY:	10 tons
NUMBER OF INCINERATORS REQUIRED:	3
TOTAL FACILITY CAPACITY:	30 tons/day
CAPITAL COSTS:	$62,834/ton
APC CAPITAL COST:	$14,281/ton
HRI CONSTRUCTION COSTS:	$2,313,435
O&M COSTS:	$30/ton
HRI O&M COSTS:	$213,315/year
LANDFILL SAVINGS:	$201,582/year
HEAT PRODUCTION:	32,436 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$148,970.86/yr
YEARLY AUXILIARY FUEL COSTS:	$6,432.09/yr
YEARLY AUXILIARY FUEL QUANTITY:	1,745 MBtu/yr
YEARLY ELECTRICITY COSTS:	$50,046.94/yr
YEARLY ELECTRICITY QUANTITY:	1,898 MBtu/yr
NET FUEL SAVINGS:	$92,492/yr

** NOTE: MBtu means MILLIONS of Btu's.

STEAM SUPPLY SUMMARY

Total Amount of Steam Produced:	32,436 MBtu/year
Yearly Amount of Steam Produced:	32,435,562 lb/year
Daily Amount of Steam Produced:	89,109 lb/day
Hourly Amount of Steam Produced:	3,713 lb/hour

AUXILIARY FUEL REQUIREMENTS

Auxiliary Fuel Type:	natural gas
Fuel Requirements:	1,745 MBtu/year
Yearly:	1,693 Kcuft/year
Daily:	4.65 Kcuft/day
Hourly:	0.19 Kcuft/hour

OPERATING SCHEDULE SUMMARY

Incinerator Operation:	7 days/week
	3 shifts/day
Daily Operation:	24 hours/day
Weekly Operation:	168 hours/week
Yearly Operation:	8736 hours/year
Effective Steaming Time:	24 hours/day

REFUSE DISPOSAL SUMMARY

Total Weight Disposed:	7,014 tons/year
	135 tons/week
	19 tons/day
Total Volume Disposed:	29,689 cuy/year

DISPLACED FUEL SUMMARY

Displaced Fuel Type:	residual oil
Amount Displaced:	40,544 MBtu/year
	270,856 gallons/year
	744 gallons/day
	31.00 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 01-01-80 21:34:08
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DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALTERNATIVES ANALYZED		LCC (NET PW) ($ X 10**3)	INITIAL COSTS++ ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**6 BTUS)
ALT ID.	DESCRIPTION/TITLE			
A	LANDFILL	2085	0	40544
B	HRI	2812	1531	1898

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

\+ INCLUDES PRE BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	1118	967	0	0	0	2085
B	1531	258	1023	0	0	0	2812

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

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SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	1531	-860	56	0	0	0	727	.5	>99

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

Session Number: 1

SUMMARY OF INPUTS	
INSTALLATION NAME:	US Military Academy
REGION:	2
WASTE TYPE:	2
HEAT CONTENT:	4500
*WASTE QUANTITY:	7,014 tpy
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$100.00/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
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NUMBER OF INCINERATORS REQUIRED:	3
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CAPITAL COSTS:	$62,834/ton
APC CAPITAL COST:	$0/ton
HRI CONSTRUCTION COSTS:	$1,885,010
O&M COSTS:	$25/ton
HRI O&M COSTS:	$175,350/year
LANDFILL SAVINGS:	$420,840/year
HEAT PRODUCTION:	32,436 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$148,970.86/yr
YEARLY AUXILIARY FUEL COSTS:	$6,432.09/yr
YEARLY AUXILIARY FUEL QUANTITY:	1,745 MBtu/yr
YEARLY ELECTRICITY COSTS:	$23,989.21/yr
YEARLY ELECTRICITY QUANTITY:	910 MBtu/yr
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DISPLACED FUEL SUMMARY

Displaced Fuel Type:	residual oil
Amount Displaced:	40,544 MBtu/year
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	31.00 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 01-01-80 21:47:44
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALT ID.	ALTERNATIVES ANALYZED DESCRIPTION/TITLE	LCC (NET PW) ($ X 10**3)	INITIAL COSTS++ ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**6 BTUS)
A	LANDFILL	3137	0	40544
B	HRI	2222	1247	910

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

++ INCLUDES PRE-BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	1118	2019	0	0	0	3137
B	1247	134	842	0	0	0	2222

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

LCCID 1.035 DATE/TIME: 01-01-80 21:47:44
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NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	1247	-984	-1178	0	0	0	-915	1.7	6

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

Session Number: 1

SUMMARY OF INPUTS	
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REGION:	2
WASTE TYPE:	2
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*WASTE QUANTITY:	7,014 tpy
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$100.00/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
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NUMBER OF INCINERATORS REQUIRED:	3
TOTAL FACILITY CAPACITY:	30 tons/day
CAPITAL COSTS:	$62,834/ton
APC CAPITAL COST:	$14,281/ton
HRI CONSTRUCTION COSTS:	$2,313,435
O&M COSTS:	$30/ton
HRI O&M COSTS:	$213,315/year
LANDFILL SAVINGS:	$335,971/year
HEAT PRODUCTION:	32,436 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$148,970.86/yr
YEARLY AUXILIARY FUEL COSTS:	$6,432.09/yr
YEARLY AUXILIARY FUEL QUANTITY:	1,745 MBtu/yr
YEARLY ELECTRICITY COSTS:	$50,046.94/yr
YEARLY ELECTRICITY QUANTITY:	1,898 MBtu/yr
NET FUEL SAVINGS:	$92,492/yr

** NOTE: MBtu means MILLIONS of Btu's.

STEAM SUPPLY SUMMARY

Total Amount of Steam Produced:	32,436 MBtu/year
Yearly Amount of Steam Produced:	32,435,562 lb/year
Daily Amount of Steam Produced:	89,109 lb/day
Hourly Amount of Steam Produced:	3,713 lb/hour

AUXILIARY FUEL REQUIREMENTS

Auxiliary Fuel Type:	natural gas
Fuel Requirements:	1,745 MBtu/year
Yearly:	1,693 Kcuft/year
Daily:	4.65 Kcuft/day
Hourly:	0.19 Kcuft/hour

OPERATING SCHEDULE SUMMARY

Incinerator Operation:	7 days/week
	3 shifts/day
Daily Operation:	24 hours/day
Weekly Operation:	168 hours/week
Yearly Operation:	8736 hours/year
Effective Steaming Time:	24 hours/day

REFUSE DISPOSAL SUMMARY

Total Weight Disposed:	7,014 tons/year
	135 tons/week
	19 tons/day
Total Volume Disposed:	29,689 cuy/year

DISPLACED FUEL SUMMARY

Displaced Fuel Type:	residual oil
Amount Displaced:	40,544 MBtu/year
	270,856 gallons/year
	744 gallons/day
	31.00 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 10-03-89 10:28:06
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALTERNATIVES ANALYZED		LCC	INITIAL	AVG. ANNUAL
ALT ID.	DESCRIPTION/TITLE	(NET PW) ($ X 10**3)	COSTS++ ($ X 10**3)	ENERGY USE (10**6 BTUS)
A	LANDFILL	2730	0	40544
B	HRI	2812	1531	1898

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

++ INCLUDES PRE-BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	1118	1612	0	0	0	2730
B	1531	258	1023	0	0	0	2812

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

LCCID 1.035 DATE/TIME: 10-03-89 10:28:06
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	1531	-860	-589	0	0	0	82	.9	20

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

Session Number: 1

SUMMARY OF INPUTS	
INSTALLATION NAME:	US Military Academy
REGION:	2
WASTE TYPE:	2
HEAT CONTENT:	4500
*WASTE QUANTITY:	7,143 tpy
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$117.92/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
TONS PER 7 DAY WEEK OF WASTE:	137 tons/week
INDIVIDUAL INCINERATOR CAPACITY:	10 tons
NUMBER OF INCINERATORS REQUIRED:	3
TOTAL FACILITY CAPACITY:	30 tons/day
CAPITAL COSTS:	$62,834/ton
APC CAPITAL COST:	$14,281/ton
HRI CONSTRUCTION COSTS:	$2,313,435
O&M COSTS:	$30/ton
HRI O&M COSTS:	$217,238/year
LANDFILL SAVINGS:	$403,463/year
HEAT PRODUCTION:	33,032 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$151,710.72/yr
YEARLY AUXILIARY FUEL COSTS:	$6,550.39/yr
YEARLY AUXILIARY FUEL QUANTITY:	1,777 MBtu/yr
YEARLY ELECTRICITY COSTS:	$50,967.39/yr
YEARLY ELECTRICITY QUANTITY:	1,933 MBtu/yr
NET FUEL SAVINGS:	$94,193/yr

** NOTE: MBtu means MILLIONS of Btu's.

STEAM SUPPLY SUMMARY	
Total Amount of Steam Produced:	33,032 MBtu/year
Yearly Amount of Steam Produced:	33,032,114 lb/year
Daily Amount of Steam Produced:	90,748 lb/day
Hourly Amount of Steam Produced:	3,781 lb/hour

AUXILIARY FUEL REQUIREMENTS	
Auxiliary Fuel Type:	natural gas
Fuel Requirements:	1,777 MBtu/year
Yearly:	1,724 Kcuft/year
Daily:	4.74 Kcuft/day
Hourly:	0.20 Kcuft/hour

OPERATING SCHEDULE SUMMARY	
Incinerator Operation:	7 days/week
	3 shifts/day
Daily Operation:	24 hours/day
Weekly Operation:	168 hours/week
Yearly Operation:	8736 hours/year
Effective Steaming Time:	24 hours/day

REFUSE DISPOSAL SUMMARY	
Total Weight Disposed:	7,143 tons/year
	137 tons/week
	20 tons/day
Total Volume Disposed:	30,235 cuy/year

DISPLACED FUEL SUMMARY	
Displaced Fuel Type:	residual oil
Amount Displaced:	41,290 MBtu/year
	275,838 gallons/year
	758 gallons/day
	31.57 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 11-22-89 09:54:28
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALTERNATIVES ANALYZED		LCC	INITIAL	AVG. ANNUAL
ALT ID.	DESCRIPTION/TITLE	(NET PW) ($ X 10**3)	COSTS++ ($ X 10**3)	ENERGY USE (10**6 BTUS)
A	LANDFILL	3074	0	41290
B	HRI	2835	1531	1933

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

++ INCLUDES PRE-BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	1138	1936	0	0	0	3074
B	1531	262	1042	0	0	0	2835

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

LCCID 1.035 DATE/TIME: 11-22-89 09:54:28
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	1531	-876	-894	0	0	0	-239	1.2	12

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

Session Number: 1

SUMMARY OF INPUTS	
INSTALLATION NAME:	US Military Academy
REGION:	2
WASTE TYPE:	2
HEAT CONTENT:	4500
*WASTE QUANTITY:	115 tpd (7 day)
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$50.00/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
TONS PER 7 DAY WEEK OF WASTE:	805 tons/week
INDIVIDUAL INCINERATOR CAPACITY:	40 tons
NUMBER OF INCINERATORS REQUIRED:	4
TOTAL FACILITY CAPACITY:	160 tons/day
CAPITAL COSTS:	$44,957/ton
APC CAPITAL COST:	$5,553/ton
HRI CONSTRUCTION COSTS:	$8,081,452
O&M COSTS:	$27/ton
HRI O&M COSTS:	$1,122,658/year
LANDFILL SAVINGS:	$1,002,547/year
HEAT PRODUCTION:	193,578 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$889,067.69/yr
YEARLY AUXILIARY FUEL COSTS:	$38,387.14/yr
YEARLY AUXILIARY FUEL QUANTITY:	10,415 MBtu/yr
YEARLY ELECTRICITY COSTS:	$210,380.02/yr
YEARLY ELECTRICITY QUANTITY:	7,978 MBtu/yr
NET FUEL SAVINGS:	$640,301/yr

** NOTE: MBtu means MILLIONS of Btu's.

STEAM SUPPLY SUMMARY

Total Amount of Steam Produced:	193,578 MBtu/year
Yearly Amount of Steam Produced:	193,577,520 lb/year
Daily Amount of Steam Produced:	531,806 lb/day
Hourly Amount of Steam Produced:	22,159 lb/hour

AUXILIARY FUEL REQUIREMENTS

Auxiliary Fuel Type:	natural gas
Fuel Requirements:	10,415 MBtu/year
Yearly:	10,102 Kcuft/year
Daily:	27.75 Kcuft/day
Hourly:	1.16 Kcuft/hour

OPERATING SCHEDULE SUMMARY

Incinerator Operation:	7 days/week
	3 shifts/day
Daily Operation:	24 hours/day
Weekly Operation:	168 hours/week
Yearly Operation:	8736 hours/year
Effective Steaming Time:	24 hours/day

REFUSE DISPOSAL SUMMARY

Total Weight Disposed:	41,860 tons/year
	805 tons/week
	115 tons/day
Total Volume Disposed:	177,185 cuy/year

DISPLACED FUEL SUMMARY

Displaced Fuel Type:	residual oil
Amount Displaced:	241,972 MBtu/year
	1,616,487 gallons/year
	4,441 gallons/day
	185.04 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 10-03-89 10:58:45
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALT ID.	DESCRIPTION/TITLE (ALTERNATIVES ANALYZED)	LCC (NET PW) ($ X 10**3)	INITIAL COSTS++ ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**6 BTUS)
A	LANDFILL	11236	0	241972
B	HRI	11757	5347	7978

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

++ INCLUDES PRE-BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	6426	4811	0	0	0	11236
B	5347	1022	5387	0	0	0	11757

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

LCCID 1.035 DATE/TIME: 10-03-89 10:58:45
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	5347	-5403	577	0	0	0	520	.9	>99

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

Session Number: 1

SUMMARY OF INPUTS	
INSTALLATION NAME:	US Military Academy
REGION:	2
WASTE TYPE:	2
HEAT CONTENT:	4500
*WASTE QUANTITY:	115 tpd (7 day)
DAYS/WEEK:	7
SHIFTS/DAY:	3
LANDFILL LIFE:	15 years
LANDFILL REPLACEMENT COST:	$0
*LANDFILL COSTS:	$100.00/ton
FUEL TYPE:	residual oil
*FUEL COSTS:	$0.55/gallons
AUXILIARY FUEL TYPE:	natural gas
AUXILIARY FUEL COSTS:	$3.80/Kcuft
*ELECTRICITY COSTS:	9.0 /KWh

* Value given differs significantly from the table value.
** NOTE: MBtu means MILLIONS of Btu's.

SUMMARY OF OUTPUTS	
TONS PER 7 DAY WEEK OF WASTE:	805 tons/week
INDIVIDUAL INCINERATOR CAPACITY:	40 tons
NUMBER OF INCINERATORS REQUIRED:	4
TOTAL FACILITY CAPACITY:	160 tons/day
CAPITAL COSTS:	$44,957/ton
APC CAPITAL COST:	$5,553/ton
HRI CONSTRUCTION COSTS:	$8,081,452
O&M COSTS:	$27/ton
HRI O&M COSTS:	$1,122,658/year
LANDFILL SAVINGS:	$2,005,094/year
HEAT PRODUCTION:	193,578 MBtu/yr
FUEL COSTS:	$3.67/MBtu
AUXILIARY FUEL COST:	$3.69/MBtu
ELECTRICITY COST:	$26.37/MBtu
ENERGY RECOVERY FACTOR:	80.0%
NUMBER OF HOURS OPERATIONAL:	168 hours/week
NUMBER OF MBtu OF FUEL NEEDED PER TON OF WASTE BURNED:	0.249 MBtu/ton
GROSS FUEL SAVINGS:	$889,067.69/yr
YEARLY AUXILIARY FUEL COSTS:	$38,387.14/yr
YEARLY AUXILIARY FUEL QUANTITY:	10,415 MBtu/yr
YEARLY ELECTRICITY COSTS:	$210,380.02/yr
YEARLY ELECTRICITY QUANTITY:	7,978 MBtu/yr
NET FUEL SAVINGS:	$640,301/yr

** NOTE: MBtu means MILLIONS of Btu's.

STEAM SUPPLY SUMMARY

Total Amount of Steam Produced:	193,578 MBtu/year
Yearly Amount of Steam Produced:	193,577,520 lb/year
Daily Amount of Steam Produced:	531,806 lb/day
Hourly Amount of Steam Produced:	22,159 lb/hour

AUXILIARY FUEL REQUIREMENTS

Auxiliary Fuel Type:	natural gas
Fuel Requirements:	10,415 MBtu/year
Yearly:	10,102 Kcuft/year
Daily:	27.75 Kcuft/day
Hourly:	1.16 Kcuft/hour

OPERATING SCHEDULE SUMMARY

Incinerator Operation:	7 days/week
	3 shifts/day
Daily Operation:	24 hours/day
Weekly Operation:	168 hours/week
Yearly Operation:	8736 hours/year
Effective Steaming Time:	24 hours/day

REFUSE DISPOSAL SUMMARY

Total Weight Disposed:	41,860 tons/year
	805 tons/week
	115 tons/day
Total Volume Disposed:	177,185 cuy/year

DISPLACED FUEL SUMMARY

Displaced Fuel Type:	residual oil
Amount Displaced:	241,972 MBtu/year
	1,616,487 gallons/year
	4,441 gallons/day
	185.04 gallons/hour

** NOTE: MBtu means MILLIONS of Btu's.

LCCID 1.035 DATE/TIME: 10-03-89 11:02:52
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

CRITERIA REFERENCE:FEDS/A-94 (Army TM 5-802-1, Para. 2-2,5&6)

DISCOUNT RATE: 10%

ALT ID.	ALTERNATIVES ANALYZED DESCRIPTION/TITLE	LCC (NET PW) ($ X 10**3)	INITIAL COSTS++ ($ X 10**3)	AVG. ANNUAL ENERGY USE (10**6 BTUS)
A	LANDFILL	16047	0	241972
B	HRI	11757	5347	7978

TABLE I. KEY DATA FOR ECONOMIC RANKING PURPOSES

++ INCLUDES PRE-BOD COSTS, IF ANY

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL
A	0	6426	9621	0	0	0	16047
B	5347	1022	5387	0	0	0	11757

TABLE II. LIFE CYCLE COST COMPARISON (ACTUAL NET PW VALUES)*

++ INCLUDES PRE-BOD COSTS, IF ANY

LCCID 1.035 DATE/TIME: 10-03-89 11:02:52
PROJECT NO., FY, & TITLE: P000 FY 93 HEAT RECOVERY INCINERATOR
INSTALLATION & LOCATION: US MILITARY ACADEMY NEW YORK
DESIGN FEATURE: ALTERNATIVE EVALUATION
NAME OF DESIGNER: GRIGGS

SUMMARY REPORT

ALT ID.	INITIAL INVEST-MENT COSTS++	ENERGY COSTS	RECURNG M&R & CUSTODL COSTS	MAJOR REPAIR & REPLACE-MENT COSTS	OTH O&M COSTS & MONETARY BENEFITS	DISPOSAL COSTS OR RETENTN VALUE	TOTAL	SIR	DPP
A	BASELINE ALTERNATIVE: ALTERNATIVE LOWEST IN INITIAL INVESTMENT COST								
B	5347	-5403	-4234	0	0	0	-4290	1.8	6

TABLE III.A INCREMENTAL LIFE CYCLE COSTS* (RELATIVE TO BASELINE)

++ INCLUDES PRE-BOD COSTS, IF ANY

*NET PW EQUIVALENTS ON SEP89; IN 10**3 DOLLARS; IN CONSTANT SEP89 DOLLARS

ARR
AMERICAN RESOURCE RECOVERY

1020 N. Broadway, Suite G-13
Milwaukee, WI 53202
414-278-6010
Fax 414-278-8508

October 12, 1989

Ken Griggs
USA CERL
P.O. Box 4005
Champaign, IL 61824

Re: Waste Incineration; US Military Academy

Dear Mr. Griggs:

I appreciate you sending me your analysis regarding waste processing at the US Military Academy. As we discussed on the phone, American Resource Recovery (ARR) has the capabilities to design, construct, own and operate municipal and hospital waste incinerator facilities with energy recovery. Our systems range in size from 20 TPD through 400 TPD. The type of technolgy we select is dependent upon specific project requirements.

Air pollution control equipment is selected on the basis of the requirements of the state in which the facility is to be constructed. ARR remains flexible in tailoring its services to meet the requirements of each individual client.

After reviewing your information, we believe the projected disposal fees would allow for a viable waste-to-energy incinerator facility to serve the needs of the US Military Academy. Whether the facility would be sized to handle the campus or, additionally process waste from surrounding communities, is a determination to be made by your group. If the plant were sized to handle only the campus, we believe it would be to the Army's advantage to consider processing the infectious waste generated from the Academy's hospital. This waste, in particular, is going to see rapidly increasing tipping fees because of the lack of proper disposal facilities.

ARR is definitely interested in proposing on this project. We are willing to provide you with any information you may need in determining the most cost effective and environmentally sound method of disposing of this waste.

Very truly yours,

AMERICAN RESOURCE RECOVERY

Dan Warren

Daniel E. Warren
Vice President

DEW/da

HARBERT/TRIGA
RESOURCE RECOVERY

November 27, 1989

Mr. Ken Griggs
USACE CERL
P.O. Box 4005
Champaign, Illinois 61820

Dear Ken:

Pursuant to our telephone conversation of this date, please be advised that Harbert/Triga Resource Recovery is most interested in developing a Total Urban Recovery Facility (T.U.R.F.) at the West Point Military Reservation.

Harbert/Triga is a partnership of Paris based Triga/SITA and U.S. based Harbert International. SITA is the leading waste management company in Europe with 70 years of experience in over 120 waste disposal facilities, including materials separation and recovery, composting and incineration. Triga is currently operating 52 plants that process over 13,000 TPD of municipal solid waste (MSW).

Triga/SITA is part of the Lyonnaise des Eaux Group, which is one of Europe's largest municipal services contractors that employs over 35,000 people worldwide and has annual revenues in excess of $3 billion.

Harbert International, founded in 1949 and still privately held, is one of the financially strongest full service engineering, construction/development firms in the United States. Over the past forty years, Harbert has designed, constructed, owned and operated energy related projects around the globe. Harbert employs over 4000 people worldwide and has annual revenues of $300-400 million.

Harbert/Triga is currently building the world's first fully integrated resource recovery facility in Bayonne-Anglet-Biarritz, France. The B.A.B. Project will include state-of-the-art front end materials separation/recovery, composting, incineration and energy recovery systems. With an overall processing capacity of 200 TPD of MSW, 26 TPD of sewage sludge and 15 TPD of infectious medical waste, this project makes maximum use of resource recovery while incinerating only 25% of its throughput.

Enclosed for your reference are several brochures highlighting Harbert/Triga's extensive experience and capabilities in the resource recovery industry. Also enclosed, is a 10 minute video which describes H/T's TURF approach that would be utilized for the West Point Resource Recovery Project.

We look forward to the opportunity of meeting with you in the near future to discuss your project development interests in more detail and how Harbert/Triga can assist you in these future endeavors.

Sincerely,

HARBERT/TRIGA RESOURCE RECOVERY

Robert E. Brown

Robert E. Brown
Marketing Representative

REB:Encls.

Clear Air® Inc.

January 1[illegible], 19[illegible]

U.S. ARMY CORPS OF ENGINEERS
ENERGY SYSTEMS DIVISION
P.O. BOX [illegible]
CHAMPAIGN, ILLINOIS [illegible]

Attention: Kenneth Griggs;

Subject: Letter of Interest for a Third Party Relationship for Solid Waste To Energy Systems:

Dear Mr. Griggs;

Clear Air Inc., a Public Utah Corporation for 20 years has a very definite interest in forming a "Third Party," business relationship with the U.S. Government on existing and or new Solid Waste To Energy Facilities at any World wide location.

We are particularly interested in the West Point Facility, as it is in the same area as the Facility that we Designed, Constructed, and Operate for the U.S. Government at Fort Dix, New Jersey.

We desire to discuss this subject with any Government representative as soon as possible. Please advise Clear Air Inc. of what we can do to further this potential business relationship.

Respectfully,;

R.W. Taylor President.

Southeast Regional Office 811 102nd Ave. North ☐ Naples, Florida 33963 ☐ (813) 598-9595

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217
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